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Bridger-Roberts
50/69 kV
transmission line

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ENVIRONMENTAL ANALYSIS ON BRIDGER-ROBERTS 50/69 KV TRANSMISSION LINE

Energy Planning Division
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SECTION I Introduction

In accordance with the Utility Siting Act of 1973, an application was filed with the Department of Natural Resources and Conservation (Department) on April 29, 1974 for permission to construct a 50/69 KV transmission line from the substation at Bridger, Montana to Roberts, Montana. This application was submitted by the Beartooth Electric Cooperative, Inc. (Beartooth REA).

On October 21, 1974 a letter was received from Beartooth REA asking the Department to defer action on the application until further information concerning the location of the transmission line corridor and substation could be submitted. This information was received December 16, 1974. The proposed substation was relocated approximately 1-3/4 miles from a point northwest of Roberts to a point southeast of town. A 3-1/2 mile section of the proposed transmission line was moved approximately 3/4 mile south of the location originally proposed.

The following sections of this report contain an engineering analysis of the proposed system and the need for the line as well as an inventory and impact analysis of elements of the natural and cultural environment which would be affected by the line. A geographic area large enough to include all reasonable routes for the proposed line between Bridger and Roberts has been selected for the study area. This area is shown in Figure I-1. A technical appendix containing supportive data for several sections of the main text is filed with the Department, the Carbon County Planning Office, the Beartooth REA Office, and the Soil Conservation Service Office in Joliet. This material is open to public inspection.

SECTION II Engineering and Need Analysis

A. Proposed Specifications

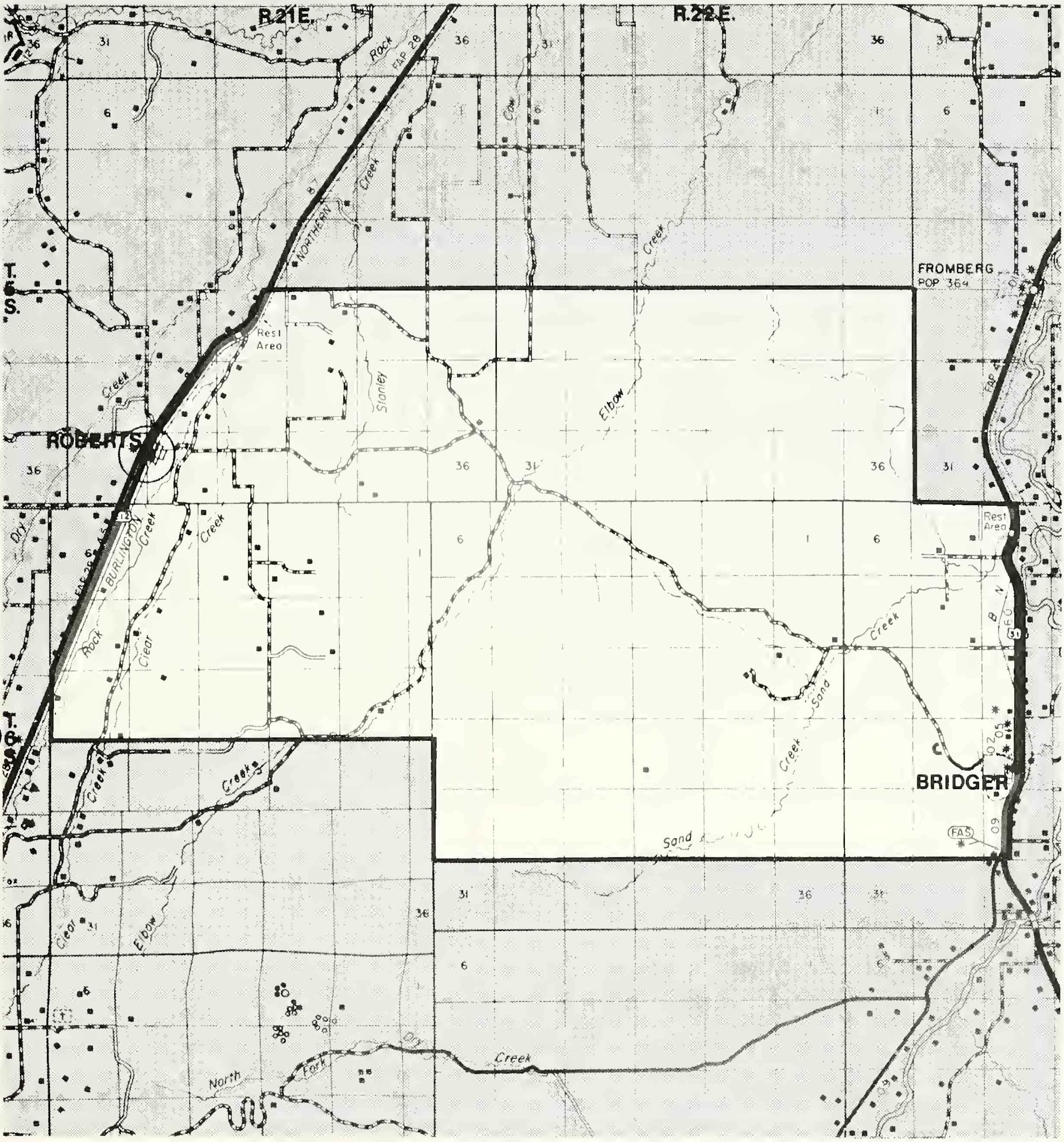
As shown in Figure II-1, the applicant has proposed to build a 50/69 KV transmission line from the Bridger substation (Figure II-2) to Roberts, a distance of about 14.5 miles. The following technical line design information was provided by the applicant.

1) Conductor size: .563" diameter (4/0 ACSR)
2) Ground wire: .343" diameter (#9 ALUM)
3) Span: Average of 474'
4) Pole: Single pole - 55' high - 7.2' foundation
5) Right of way: 20', minimum 24' midspan clearance
6) Guy wires will be used at angles if required
7) Insulator: 4 or 5 per conductor, standard porcelain type, 8" to 10" in diameter each

B. Related Meetings and Discussions With the Applicant

A meeting was held on October 15, 1974 with the Beartooth Electric Cooperative (REA) manager, Mr. Raymond Hyvonen, and another on February 18, 1975 with Mr. Jim Pickens, the Consultant Engineer for the REA. In both meetings the need for the proposed line and different alternatives were discussed, and questions were answered for Department staff members.

Mr. Pickens mentioned that the REA needs the line for the winter of 1975-76. Materials, poles, conductors, etc. will be ordered as early as possible so that they can be received on time and the line constructed before the winter of 1975-76. Oral agreements and support from land owners for the right of way have been received.



STUDY AREA OF THE PROPOSED BRIDGER TO ROBERTS TRANSMISSION LINE

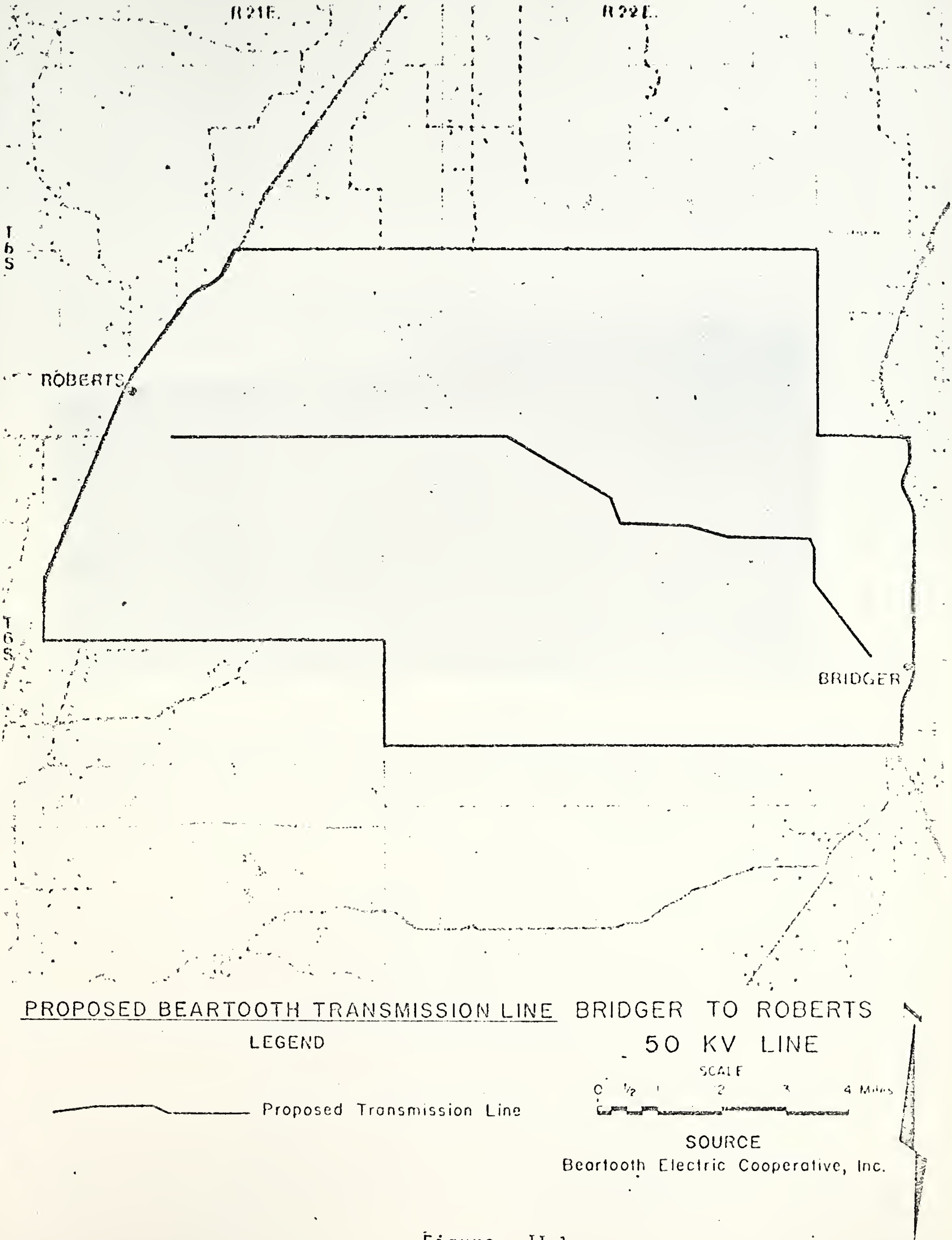
BRIDGER TO ROBERTS 50 KV LINE

SCALE:

0 ½ 1 2 3 4 Miles

N

FIGURE I-1



PROPOSED BEARTOOTH TRANSMISSION LINE BRIDGER TO ROBERTS

50 KV LINE

SOURCE
Beartooth Electric Cooperative, Inc.

Figure - II-1

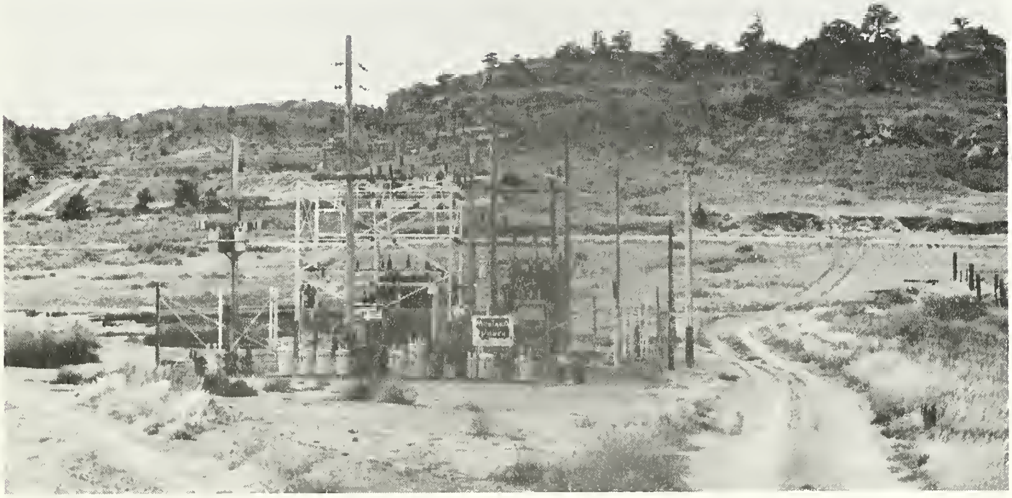


Figure II-2. This Montana Power substation located west of Bridger and backgrounded by Eagle Sandstone cliffs, serves Bridger and outlying areas. According to Hart (1975), the Bridger-Roberts line will terminate here temporarily until a substation is completed south of Bridger.

C. Need Analysis

1. Present Transmission System

The applicant presently obtains all power from the Montana Power Company, and at this time, does not own or operate any transmission lines. Two existing 50 KV transmission lines form a "loop" between the Mystic Lake hydro plant and Laurel. One line goes to Absarokee, Columbus and Laurel and the other goes to Red Lodge, Bridger, Fromberg, Edgar, Clark Fork and Laurel. The years of construction of these lines are as follows:

	Name of Line	Year Built	Length (miles)
1)	Mystic Lake to Columbus	1929	38.7
2)	Columbus to Laurel	1910	25.9
3)	Mystic Lake to Red Lodge	1923	26.8
4)	Red Lodge to Fromberg	1920	26.0
5)	Fromberg to Edgar	1923	8.5
6)	Edgar to Clark Fork	1925	12.3
7)	Clark Fork to Laurel	1952	3.7

Except for the Clark Fork to Laurel line, all of the above lines are about 50 years old. Dependability decreases with age and power losses increase as load increases. The existing transmission system in the Roberts service area is shown in Figure II-3.

The "outages" for the Mystic Lake-Red Lodge-Bridger-Laurel line for the years 1966, 1968, 1970 and 1972 are given below:

Year	Outages Voluntary	Outages Involuntary
1972	105 Hrs.	81 Hrs.
1970	12 Hrs.	19 Hrs.
1968	19 Hrs.	20 Hrs.
1966	23 Hrs.	45 Hrs.

Source: Laurel to Bridger application. Further information for additional years is located in Table II-1.

2. Critical Problems

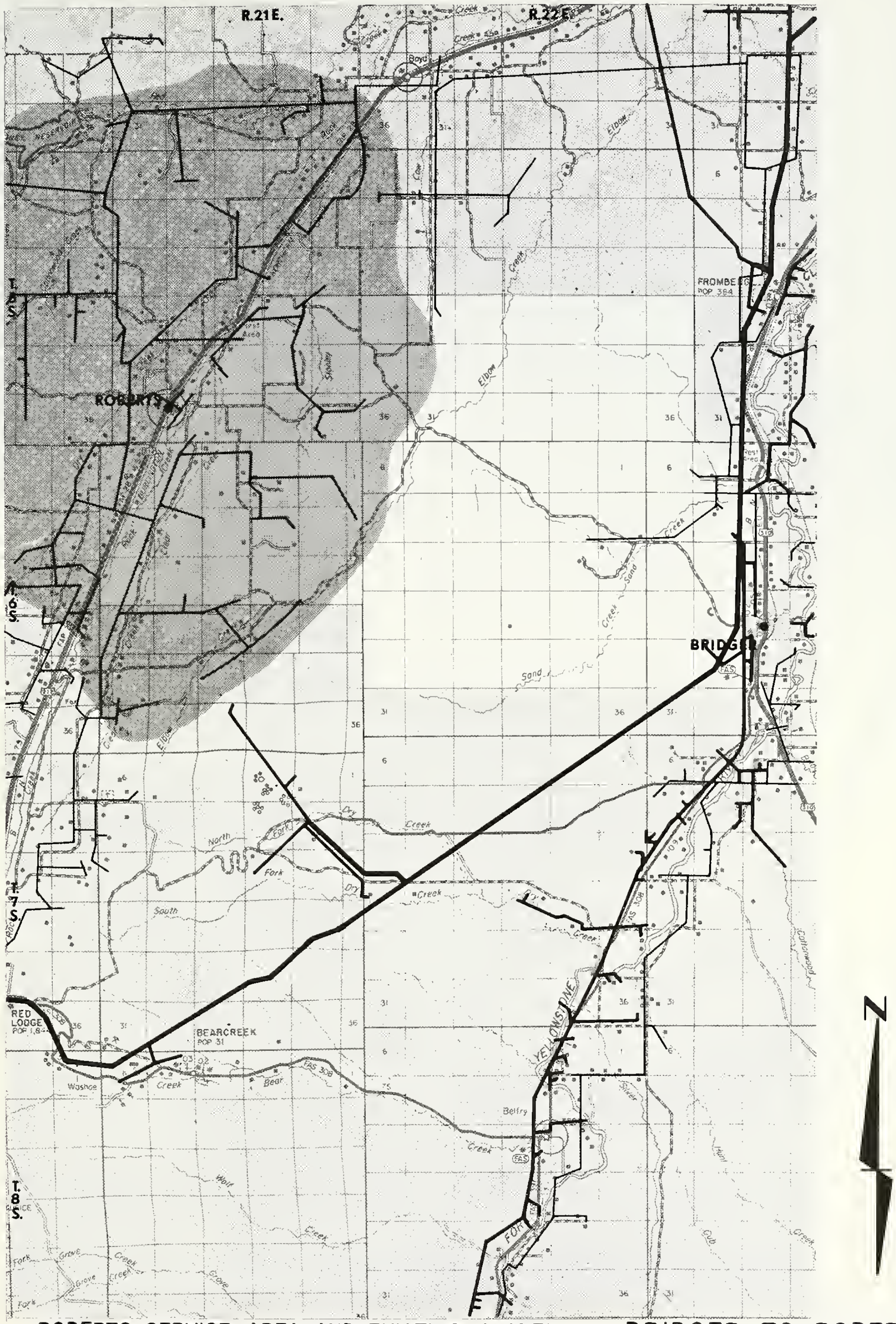
The Roberts area presently receives power from the Edgar substation through a 12.5 KV line which is 15 miles long. The voltage drop at the end of this line is very high. The level of voltage drop accepted by the Montana Public Service Commission, in normal cases, is ±8 volts on a 120 volt system and ±15 volts in emergency cases. In the Roberts area voltage drops in normal cases, calculated for the winter of 1975-76, go above ±15 volts (see Figure II-4). Also, reliability of service in the Robert's service area is poor. The main reason is that it has only one power supply source, the Edgar substation. When there is a fault on the 50 KV transmission line from Laurel to Edgar, the Roberts area will be out of service. In an October 15, 1974 meeting, the REA manager mentioned that the Roberts area was out of service for 5 days due to a fault on the 50 KV transmission line in the 1972 fiscal year.

3. Historical Load Pattern and Projected System Load

The following information was submitted in the applicant's long range system plan of 1971:

Historical System Load

Year	1961	1962	1963	1964	1965	1966
Peak Load In KW	2770	3128	3237	3464	3365	3552
Year	1967	1968	1969	1970		
Peak Load in KW	4173	4400	3689	5332		



ROBERTS SERVICE AREA AND EXISTING SYSTEM

━ MPC Transmission

— MPC Distribution

— REA Distribution

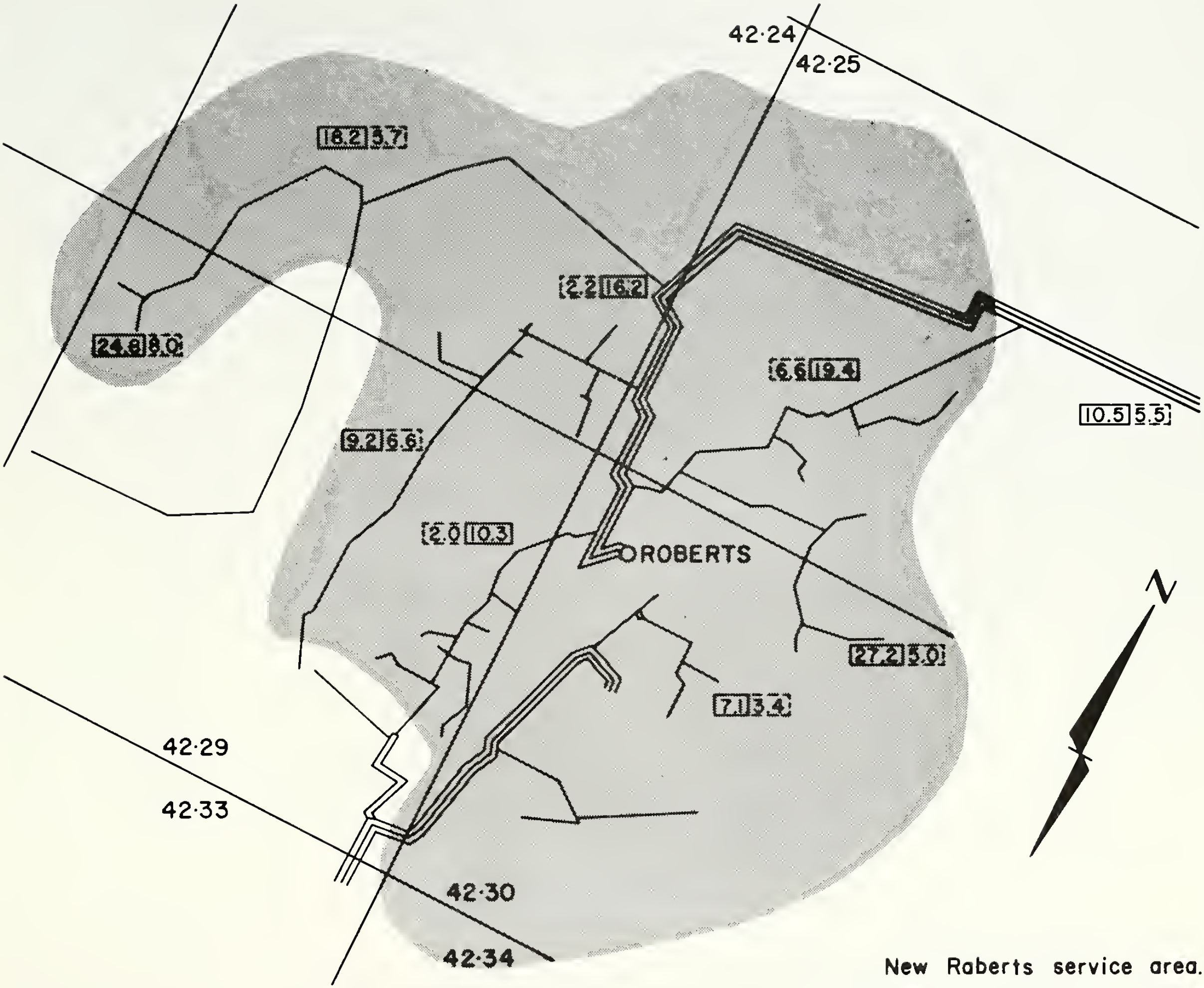
▨ Approximate Boundary of Roberts Service Area

BRIDGER TO ROBERTS
50 KV LINE

SCALE:
0 1 2 3 4 5 Miles

SOURCE: Application of Beartooth Rural Electric Cooperative

FIGURE II-3



New Roberts service area. Figures in the boxes indicate valtage drap at variaus points. Figures in the dashed baxes are voltage drops with new Raberts substatian after 50/69 KV line.

ROBERTS SERVICE AREA AND EXISTING SYSTEM

SCALE

0 1/4 1/2 3/4 1 Mile

SOURCE:
BRIDGER – ROBERTS APPLICATION

FIGURE II–4

TABLE II-1

Consumer Hour Outage Time Due to Wholesale Power Supplier (Montana Power Co.)

Consumer Hour Outage Time: All Substations

1970	7,852 hrs.
1971	16,835 hrs.
1972	9,303 hrs.
1973	87,631 hrs.
1974	16,869 hrs.
	138,490 hrs.

Consumer Hour Outage Time:
Red Lodge Substation and Edgar-Fromberg Substation

	Red Lodge Sub.	Edgar-Fromberg Sub.
1970	353 hrs.	0
1971	7,266 hrs.	4,217 hrs.
1972	1,127 hrs.	2,220 hrs.
1973	27,620 hrs.	27,472 hrs.
1974	2,660 hrs.	1,410 hrs.
	39,026 hrs.	35,319 hrs.

With the addition of the proposed Roberts Substation, the applicants feel they can reduce the outage time for the Red Lodge and Edgar-Fromberg areas.

REA MANAGER 1975

Projected System Load

Year	1971	1972	1973	1974	1975	1976	1977
Peak Load in KW	5380	5900	6500	7120	7820	8600	9450
Actual Load	5454	6927	6716	6668	7189		

The higher load growth from 1973 to 1977 is due to electrical heating of houses and other developments. More detailed estimates of this type of load are given in Table II-2 for the Red Lodge area

D. Alternatives

The applicant has conducted detailed need studies, all of which are well documented in their "Long Range System Plan 1971." In the long range plan the applicant discusses different alternatives and a proposal which involves a minimum of new transmission line corridors, best reliability, acceptable voltage drop levels and longer years of service.

One of the engineering alternatives is to build a 50 KV line from Red Lodge to Roberts. However, this line would not increase reliability of service in the Roberts area because that area would still have one point power delivery. It should be noted that Red Lodge also receives its power from one source.

Another problem is that there is not enough power in the Red Lodge area to serve both Red Lodge and the Roberts area. The power requirement in the Red Lodge area is increasing. A new system should be able to provide the Red Lodge area and Roberts with enough power for future demands and for emergencies when the Mystic Lake plant is

Table II-2

Schedule
Rock Creek Mine Rate

Estimation of Loads:

January 1, 1975	150 KW-350 KW	One sewer lift and one condominium.
September 1, 1975	250 KW-600 KW	One sewer lift and two condominiums.
September 1, 1976	375 KW-325 KW	One sewer lift and several condominiums.
September 1, 1977	500 KW-1325 KW	One sewer lift and several condominiums.

Maximum Load Sometime after 1977 is Estimated to be:

		Winter w/heat	Summer w/heat or Air-conditioning
Condominium #1	3ϕ 208/120 Y-1 meter	400	200
Condominium #2	3ϕ 208/120 Y-1 meter	400	200
Condominium #3	3ϕ 208/120 Y-1 meter	500	250
Condominium #4	3ϕ 208/120 Y-1 meter	400	200
Condominium #5	3ϕ 208/120 Y-1 meter	400	200
Restaurant	3ϕ 208/120 Y-1 meter	500	500
28 Town House Units	1ϕ 240/120 Δ-14 meters @ 50 KW	1400	1400
Area Lighting		50	50
10 Homesites	1ϕ 240/120 Δ-10 meters @ 50 KW	500	500
Swimming Pool	3ϕ 208/120 Y-1 meter	100	50
		4650 KW	3450 KW

This is a load that will be added to the Red Lodge substation in various stages as listed below. This load developed this year and was not included in the long range study.

REA Manager 1975

out of operation. Also, power coming from Laurel-Red Lodge, 50 miles away, and from Red Lodge-Roberts, 14 miles further away, means the 50 KV line would be 64 miles long. If the line carries a load of more than 1000 KW, the voltage drop at Red Lodge would be more than 16% (allowable drop is ±15% in emergencies).

The situation discussed above was also considered for the Bridger area. At Bridger, the Montana Power Company has two transmission lines coming from Laurel, one 50 KV and one 100 KV. It would be best to tap the 100 KV line to solve voltage drop problems and transmit enough power to the Roberts area to take care of part of the Red Lodge substation service area up to 1990 projections. The reliability would also be better because there are two transmission lines at Bridger. One of the requirements made by the Department in approving the 100 KV line from Laurel to Bridger was that the line should also provide power for the Edgar, Fromberg, and Red Lodge areas (Laurel-Bridger 100 KV line application).

In conclusion, the problems discussed above for the Roberts area would be solved by connecting either a 100 KV or 50 KV transmission line to the Bridger substation 14 miles away.

III. BIOPHYSICAL INVENTORY AND IMPACTS

A. Geology and Physiography

1. Geological Inventory of Study Area

The study area lies in the valley of the Clarks Fork of the Yellowstone River between the Beartooth and Pryor Mountain uplifts. It consists of a dissected upland bench with prominent ridges and escarpments which lie between Rock Creek and the Clarks Fork River. Elevations vary from 3700 feet near Bridger to nearly 5000 feet on some of the higher ridges.

The geology of the region has been described by Bevan (1921), Blackstone (1947), Bryson (1952), Calvert (1917), Field (1932), Howland et al. (1936), Patterson (1963 a&b), Ritter (1967), Smith (1963), Washburne (1908), and Wilson and Rowe (1915). Exposed formations in the study area consist exclusively of rocks of sedimentary origin, i.e., sandstones, shales, mudstones, and interbedded limestones, which are of Cretaceous or younger age. Mountain-building during late Cretaceous and early Tertiary resulted in the uplift of massive fault blocks that created the Pryor and Beartooth Mountains as well as stresses in sedimentary bedrock that led to lateral displacement along faults. The Fromberg fault (see Figure III-1), the major fault in Carbon County, crosses the study area between Bridger and Roberts and shows a lateral displacement greater than two miles. Knappen and Moulton (1931) indicate that this and other faults in the area have resulted from a single post-Cretaceous deformation. The Rock Creek Valley north of Red Lodge was glaciated during the Pleistocene and some of the terraces and gravel along Rock

Creek are thought to be overlain by glacial drift (Alden 1932; Bevan 1923). Table III-1 is a summary of the post-Jurrasic stratigraphy of the study area. Figures III-2 and III-3 depict Eagle Sandstone Cliffs in the study area locally known as the "Big Hills" and "Little Hills".

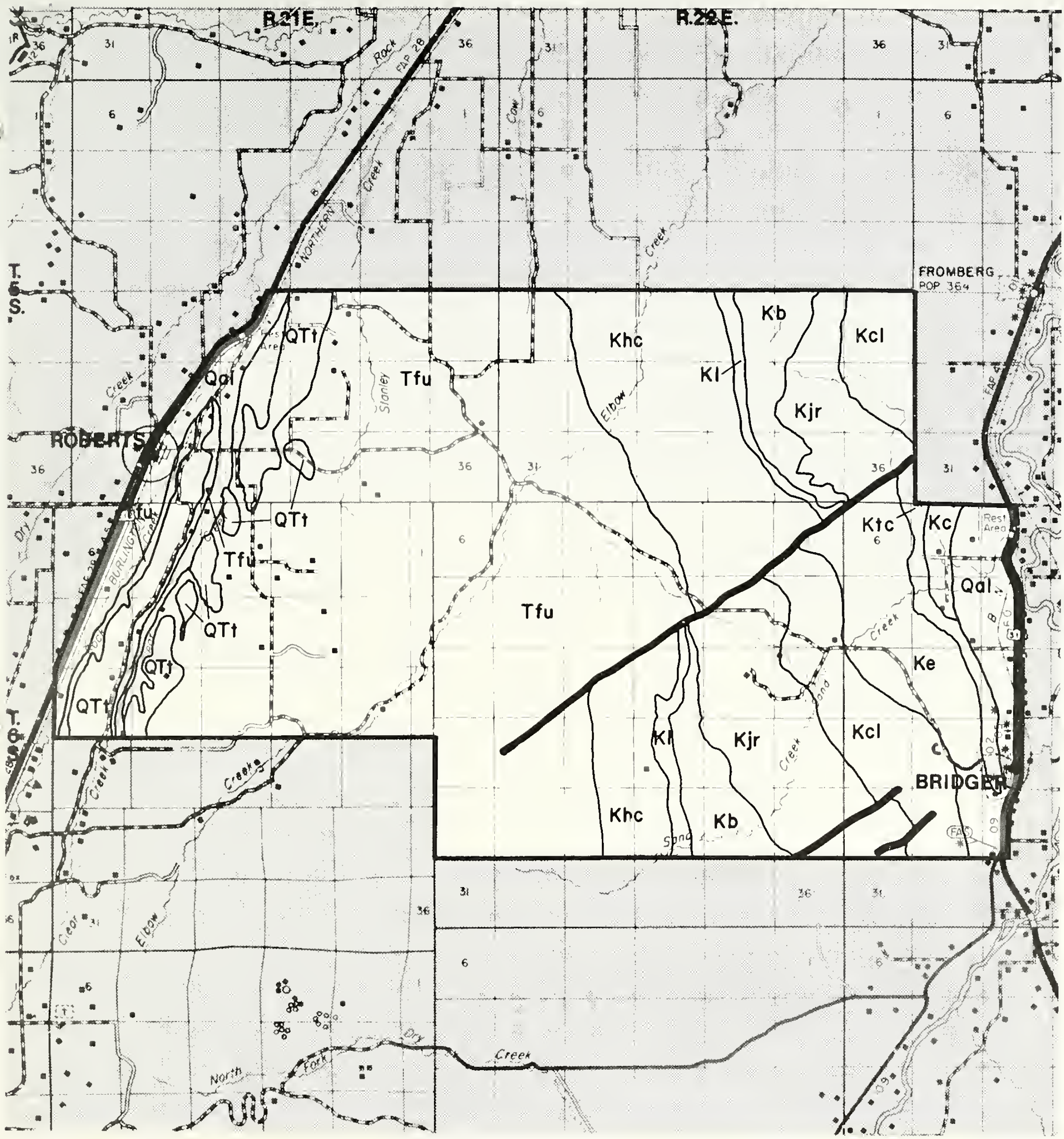
2. Mineral Resources

a. Coal

The Bridger Coal Field is an important coal deposit found within the Eagle Sandstone formation (see Table III-1). It occurs as relatively good-quality, sub-bituminous coal in beds 2.5-6.0 feet thick, cropping out along the valley or shelf just west of the ridge west of Bridger and Fromberg. structurally, the coal field is a monocline extending south-southwest from the west slope of the Pryor Mountain uplift. A local anticline appears on Rock Creek near Roberts and extends some distance southeastward.

b. Oil and Gas

There are no known oil and gas fields within the study area, but producing wells are located a few miles away. The Golden Dome area within T7S, R22E, a series of faulted half-domes within the Nye-Bowler lineament described by Wilson (1936 and 1938), has yielded gas-condensate from the Greybull member of the Cloverly formation. The Dry Creek oil and gas field, a complex faulted, elliptical dome within the Nye-Bowler lineament, produces oil from the Greybull sandstone and Pryor conglomerate (members of the Cloverly formation), and gas from the Eagle sandstone, Frontier sandstone, and the Greybull sandstone formations. Exploratory natural gas wells have been drilled within the study area.



GEOLOGY

Qal	Alluvium	Kjr	Judith River
QTt	Terrace Gravels	Kcl	Claggett
Tfu	Fort Union	Ke	Eagle
Khc	Hell Creek	Ktc	Telegraph Creek
Kl	Lennep	Kc	Cody
Kb	Bear Paw	━	Fault

BRIDGER TO ROBERTS
50 KV LINE

SCALE:
0 ½ 1 2 3 4 Miles

N

SOURCE:
Knappen and Moulton 1931,
Zeller 1963, MWRB 1969

FIGURE III-1

TABLE III-I Stratigraphic Section of the Study Area

ERA		STRATIGRAPHIC UNIT		THICKNESS (feet)	HYDROLOGIC CHARACTERISTICS	COMPONENTS	REMARKS	SOURCES[1]
CENOZOIC	Quaternary		Quaternary alluvium	5 to 80 (Ave. 30)	Most water wells are in alluvium along Rock Creek and the Clarks Fork. Yields of 10 to 300 gpm[2] reported; larger yields possible locally.	Unconsolidated or weakly consolidated gravel, sand, silt, and clay deposited by moving water.	Slightly thicker along the Clarks Fork than along Rock Creek.	Knappen & Moulton (1931); SCS (1970); Zeller (1963); USDA (1970).
			Terrace gravels	7 to 115 (Ave. 20)	Commonly used sources of groundwater; can be depleted rapidly. Yields of 10 to 50 gpm reported; 1,000 gpm also reported locally.	Stratified coarse-grained gravel, sand, and silt, both fluvial and glaciofluvial in origin.	Preserved only on small isolated gravel-capped buttes along the Rock Creek and Clarks Fork Valleys.	Zeller (1963); Ritter (1967); Flueckinger (1970); Mackin (1937).
	Tertiary		Fort Union formation	600 to 8,500	Sandstones and some coal beds within the Fort Union are regional sources of groundwater, but the shales and clays are impervious and do not yield water rapidly. Sandstone units within this formation are not normally continuous over extensive areas, but still provide water for many low-yield (less than 50 gpm) wells.	Shales, clays, and coal beds.	The most extensive surface formation in the study area.	
MESOZOIC	Cretaceous		Hell Creek formation	100 to 600	Yields of 1 to 15 gpm reported.	Medium-grained sandstone and siltstone containing many concretions with minor amounts of claystone and carbonaceous shale.	The "Devil's Kitchen", also known as "Gumbo Hill", consists of eroded sandstone within this formation.	Zeller (1963); G. Judkins (1975).
		Montana Group	Lennep sandstone	125 to 300	Unknown potential.	Dark green-brown beds of hard, well-cemented, lenticular sandstones and sandy clay and shale.	Usually develops an escarpment above the underlying soft shale.	Zeller (1963).
			Bearpaw shale	250 to 1,000	Not normally an aquifer.	Soft grey marine shale or clay including several thin beds of hard, well-cemented sandstone and a thin conglomerate limestone.		Knappen & Moulton (1931).
			Judith River sandstone	600	Sandstones commonly water-bearing; Yields of 1 to 40 gpm reported.	Alternating beds of sandstone and Sandy clay or (more rarely) shale.		
			Claggett formation	550 to 675	Sandstones within the formation, specifically the Parkman, can be waterbearing.	Soft gray shale including 20-40% light gray or white sandstone.	The upper sandy member of this formation has been correlated with the Parkman Sandstone of Wyoming	Knappen and Moulton (1931)
			Eagle formation	200 to 250 (600 max. reported)	Yields of 12 to 330 gpm reported.	Thick, massive sandstone above and below, with an intermediate layer of soft shale and sandstone. The basal member, the Virgelle sandstone, is from 60-140' thick.	The Bridger Coal Bed occurs in the upper part of the shaley member of this formation. The "Big and Little Hills" west of the Clarks Fork Valley are prominent escarments within this formation.	Darton (1907); Knappen & Moulton (1931); G. Judkins (1975).
			Telegraph Creek formation	180 to 300	Yields of 1 to 18 gpm reported; potential for larger yields exists.	Yellow sandy shale and sandstone.		Knappen & Moulton (1931)
		Colorado Group	Basal Cody shale	400 to 1,500	Unknown potential; not normally considered an aquifer.	Black shale with some sandy shale and numerous layers of black siderite concretions.		Knappen & Moulton (1931) ; Washburne (1908).
			Frontier formation	500 to 825	Includes one or more sandstone aquifers; water usually is mineralized. The Torchlight member is capable of producing flowing wells.	Interbedded sandstones and shales, including the Torchlight sandstone.	Locally contains oil and gas	
			Mowry-Thermopsis formations	350 to 1,000	Certain sandstones may locally be water-bearing, but the overall interval is not considered a reliable aquifer.	Gray sandstones and black and gray shales.		
		Cloverly	Dakota formation	200 to 600	Artesian aquifer, flowing yields from Greybull sandstone.	Sandstone, shales.	Contains oil and gas	
			Kootenai formation		Mosser sandstone may be water-bearing.	Vari-colored shale, sandstone	Contains oil and gas	
			Lakota formation		Flowing yields from Pryor conglomerate. A water flow of 6 gpm at a depth of 1,360 ft. was reported from an oil exploration well.	Sandstone, shales.	An important oil and gas horizon	

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[1] Montana Water Resources Board (1969) was used as a source throughout; additional source [illegible] listed.

[2] gallons per minute

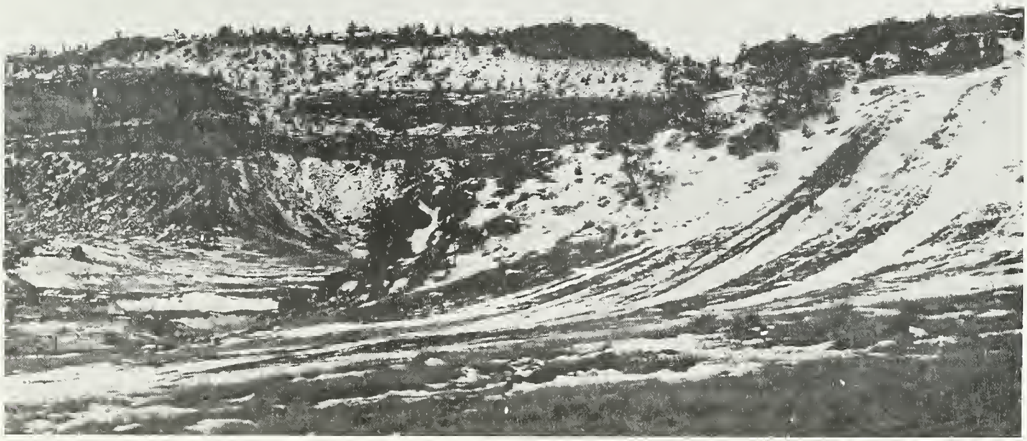


Figure III-2. The "Little Hills" (foreground) and "Big Hills" (background) of the Eagle Sandstone formation are located west of Bridger. A peregrine falcon was observed on the cliffs of the "Little Hills" in this area.

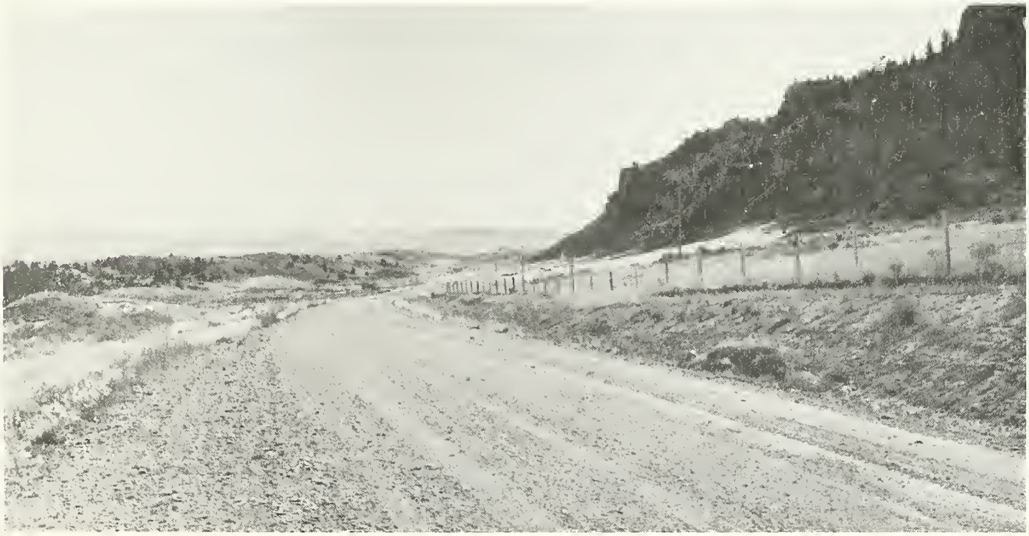


Figure III-3. Prominent cliffs of the Eagle Sandstone formation, the "Big Hills" are visible from the Bridger-Roberts road, one mile northwest of Bridger. The left side of the road is representative of a landscape without fences or powerlines.

c. Bentonite

Undeveloped deposits of this mineral, used for drilling mud in the petroleum industry and lining canals and reservoirs, are found in extensive deposits east of the Clarks Fork. Smaller deposits occur locally within the study area (SCS 1970).

d. Limestone

Bentley and Mowat (1967) reported important limestone deposits approximately one-half mile west of Bridger.

e. Clay

Some clays found within the Fort Union formation are of commercial value (SCS 1970).

f. Shale

The Cretaceous shale beds west of Fromberg provided clay for a now inoperative brick plant (SCS 1970).

3. Impacts of Proposed Action

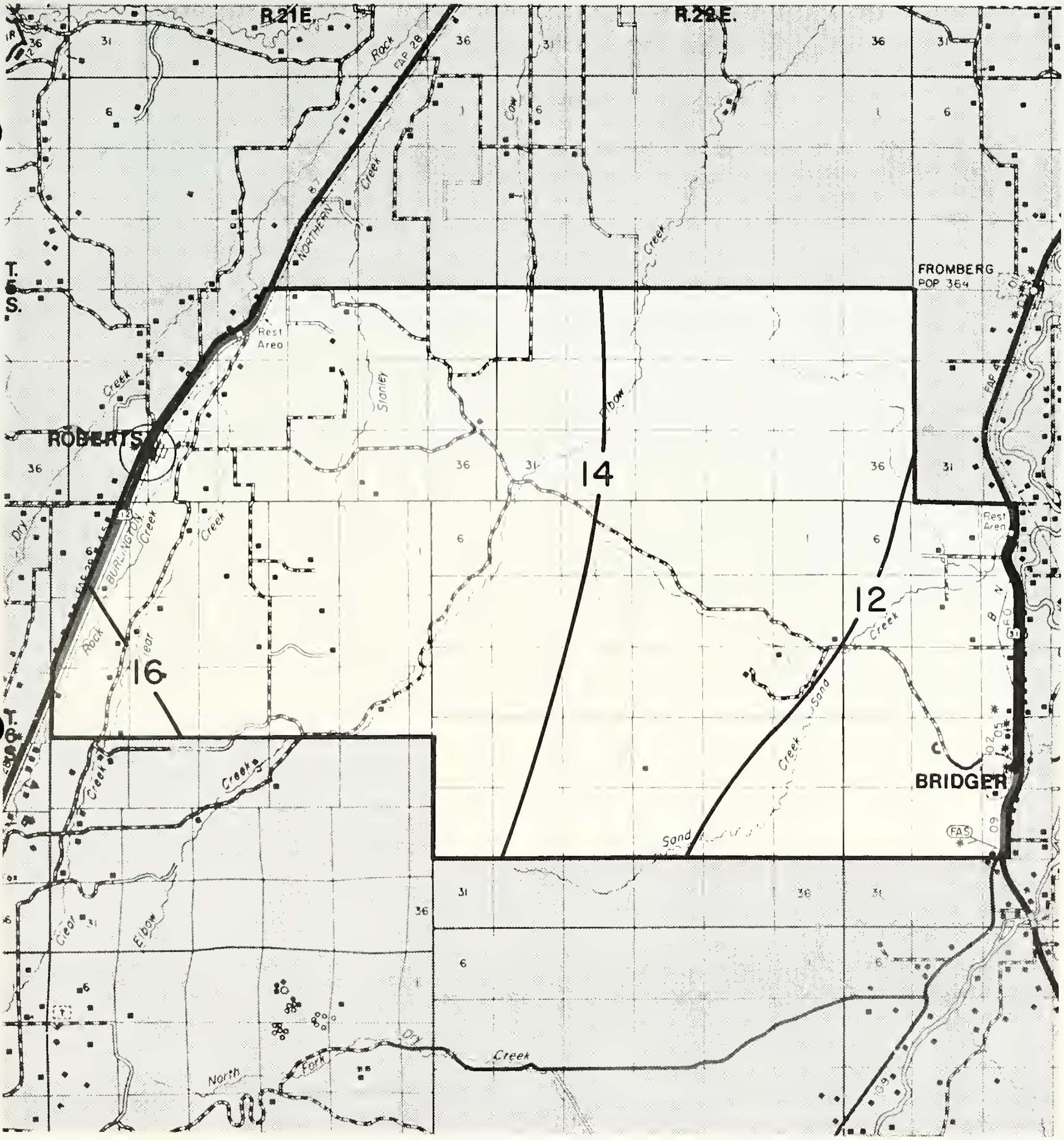
Construction of a 69 KV transmission line in the study area would not adversely affect geological formations or prevent future mining or drilling activities. Also, the prominent faults apparent between Bridger and Roberts do not pose a threat to the reliability of the transmission line. More important are the limitations placed upon construction activities and machinery movement by geologic structures, especially cliffs and escarpments. These physiographic features should be avoided as much as possible because of the difficulty involved in restricting environmental disruption to the immediate area.

B. Climate

1. General Climatic Features

The climate of the study area is characterized by low precipitation, hot summers, and cold winters. Precipitation in the region (see Figure III-4) is strongly influenced by the Beartooth Mountains which intercept most of the moisture carried by the prevailing winds. The average annual precipitation varies from 16 inches near Roberts to as low as 10 inches near Bridger. Total precipitation for 1973, which was a relatively wet year, is given in Table III-2 for four recording stations in the vicinity of the study area. Red Lodge, which is 13 miles nearer the mountains than Roberts, receives an average of over 20 inches per year. Nearly half of this precipitation falls during the months of April, May, and June, usually in the form of very intense, short-lived storms. The average annual snowfall at Red Lodge is 107.5 inches, which is equivalent to 10.75 inches of rainfall, or over half the total average annual precipitation (USDI 1970; USDC 1974; Tuinstra 1967). High spring precipitation coupled with spring runoff occasionally causes flooding along Rock Creek and the Clarks Fork and the low summer precipitation generally leads to water shortages in late summer.

Average temperatures, temperature extremes, and lengths of the frost-free season in 1973 in the study area are also shown in Table III-2 for the Bridger, Joliet, and Red Lodge recording stations.



PRECIPITATION ZONES

LEGEND

14 Isopleths

BRIDGER TO ROBERTS 50 KV LINE

SCALE:

0 ½ 1 2 3 4 Miles

N

SOURCE:

Beartooth R. C. & D. Project

FIGURE III-4

TABLE III-2

Total Precipitation, 1973[1]

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann
Bridger	.52	.05	2.86	3.57	.66	.33	.14	.24	3.08	1.28	.71	.72	14.76
Joliet	.55	.20	3.24	2.15	.77	.81	.82	.90	3.00	1.17	.84	1.09	15.54
Red Lodge	1.35	.27	6.08	7.32	1.23	1.58	.97	1.07	5.17	1.40	1.85	1.73	30.02*
Roberts	.41	.13	1.82	2.61	.74	.95	.22	1.46	4.13	.55	1.09	.76	14.87

*10.00 inches above normal

Average Temperatures, 1973[1]

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann
Bridger	23.0	30.7	37.9	42.1	54.2	64.7	71.1	71.3	57.9	51.3	32.1	31.7	47.3
Joliet	22.4	30.0	36.8	41.0	52.4	62.4	68.1	69.4	56.8	50.4	31.5	29.5	45.9
Red Lodge	21.5	26.8	31.9	34.9	48.9	59.0	65.0	65.9	50.9	46.5	29.3	27.6	42.4

Temperature Extremes and Freeze Data, 1973[1]

	Highest	Date	Lowest	Date	Length of Frost Free Season
Bridger	102	July 10	-21	January 8	108
Joliet	101	July 10	-26	January 4	106
Red Lodge	92	August 20	-21	January 9	88

[1] Source: U.S. Department of Commerce Environmental Data Service, Annual Summary of Climatological Data, 1973

2. Impacts of Proposed Action

Construction and operation of a 69 KV transmission line would have no impacts upon the climate of the area. However, climate will pose a serious threat to the reliability of the line. The frequent occurrence of icing and high winds must be given careful consideration in designing the line.

C. Hydrology

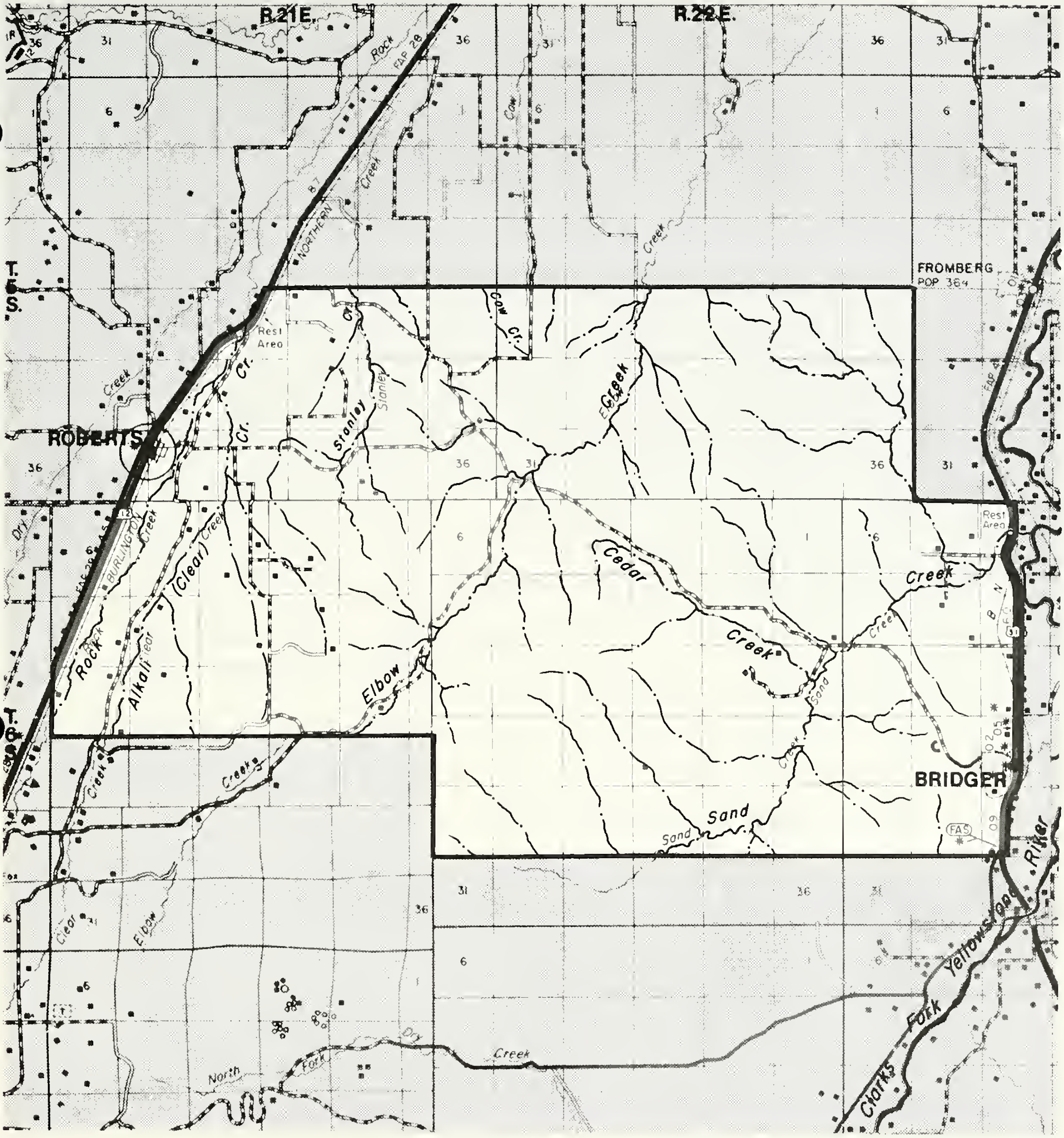
1. General Hydrologic Conditions

a. Surface Water

The study area lies entirely within the Clarks Fork river basin between the Clarks Fork of the Yellowstone River and Rock Creek, a tributary of the Clarks Fork. Discharges and turbidities of major streams in the area are given in the technical appendix. Figure III-5 shows the major drainage patterns in the area.

The Clarks Fork River is the major stream of the region. It originates in the Beartooth Plateau and flows north-northeast to enter the Yellowstone River near Laurel. Prior to the uplift of the Pryor Mountains, the lower Clarks Fork may have been a tributary to Rock Creek (MWRB 1969). Rock Creek originates at Glacier Lake in the Beartooth Plateau and flows northeast to enter the Clarks Fork near Rockvale. Other streams within the study area, including Clear Creek, Stanley Creek, Elbow Creek, Cedar Creek, and Sand Creek, may become intermittent in late summer.

Sedimentation of streams due to erosion is a serious problem in the study area (Marcuson 1969 and 1971; Ruff et al.



MAJOR DRAINAGE PATTERNS

BRIDGER TO ROBERTS
50 KV LINE

SCALE:
0 ½ 1 2 3 4 Miles

N

SOURCE:
Montana D. N. R. & C. 1973

FIGURE III-5

1973; USDA 1970; MWRB 1969; DNRC 1973; Tuinstra 1967). The major causes of erosion leading to sedimentation are overgrazing, irrigation runoff, high-intensity storms, erosive soils, steep slopes, and sparse vegetative cover (DNRC 1973). Cropland, over-grazed rangeland, and areas of man-caused disturbances are the most significant sources of sediment in the area (Marcuson 1971; DNRC 1973).

A channel clearance and realignment program along Rock Creek was carried out by the U.S. Department of Agriculture in 1958. This program destroyed much fish habitat, but was unsuccessful in curbing sedimentation problems (Marcuson 1971). Studies along Rock Creek have shown that erosion and instability of stream channels are greater where intense overgrazing has occurred than in lightly grazed areas (Tuinstra 1967; Marcuson 1971). Intensive agriculture has also been shown to cause increased sedimentation (Peters 1967; Zillges 1971). Many sections of actively eroding stream banks occur along the Clarks Fork and it's tributaries. Elbow Creek appears to be a particularly significant source of sediment entering the Clarks Fork (DNRC 1973). Poor location and design of roads, culverts, and trails are causing extensive problems in some areas, with ruts in roads ultimately becoming gullies up to five feet deep (DNRC 1973)

b. Ground Water

The availability of ground water is closely related to geologic events and changing conditions of the environment associated with development of the present physiography. During the mid-Tertiary mountain building epoch, structural patterns developed in response to new stresses placed upon a system of ancient faults and fractures. These patterns strongly influence groundwater distribution. The Clarks Fork River and Rock Creek are also highly important in the development of the existing ground water regime. Bedrock geology has a pronounced effect on the development of surface drainage and on the distribution of ground water. Characteristics of individual geological formations as aquifers are discussed in Table III-1.

Most of the water wells for domestic and livestock use are drilled into unconsolidated aquifers, while most of the groundwater discharge from bedrock is used for irrigation.

Amounts of groundwater, groundwater availability, and effective recharge for several aquifers in the area are given in the technical appendix. Chemical analyses of groundwater and municipal water supplies for selected areas in Carbon County are also located in the technical appendix.

Shortages of irrigation water or municipal and rural water, high water tables, and poor water quality are potential or existing problems of local importance.

2. Impacts of Proposed Action

Road construction and off-road movement of heavy equipment would adversely affect surface water quality through sedimentation and siltation. Groundwater would not be affected by transmission line construction or operation per se, but residential development within the study area in response to increased power availability could significantly affect the groundwater regime. Groundwater suitable for domestic wells is available throughout the study area, although depth to aquifer may deter development in certain locations. A major use of the power to be supplied to Roberts will be the operation of irrigation pumps. This increased use of groundwater may affect the water table in alluvium along Rock Creek.

D. Soils

1. Soil Resource Characteristics

Soils are naturally occurring bodies composed of both biological and physical elements which are capable of supporting the growth of higher plants. Soils develop concomitantly through time with the plant communities which they support. Five basic parameters (climate, parent material, time, relief and biotic elements) are the fundamental factors which control the kinds of soils found in an area. No single input controls the developmental processes except in the most severe or restricted cases.

In many ways, the soil system controls both the type and productivity of the biotic communities found in the study area through characteristics such as inherent fertility levels, degree of wetness or drainage, moisture holding capacity and salinity or salt levels. There are two distinct groups of biotic systems in the study area, i.e., the agricultural, urban or industrialized areas and secondly, those lands which support basically native plant communities and are now used as rangeland or a combination of forage, timber, and wildlife uses.

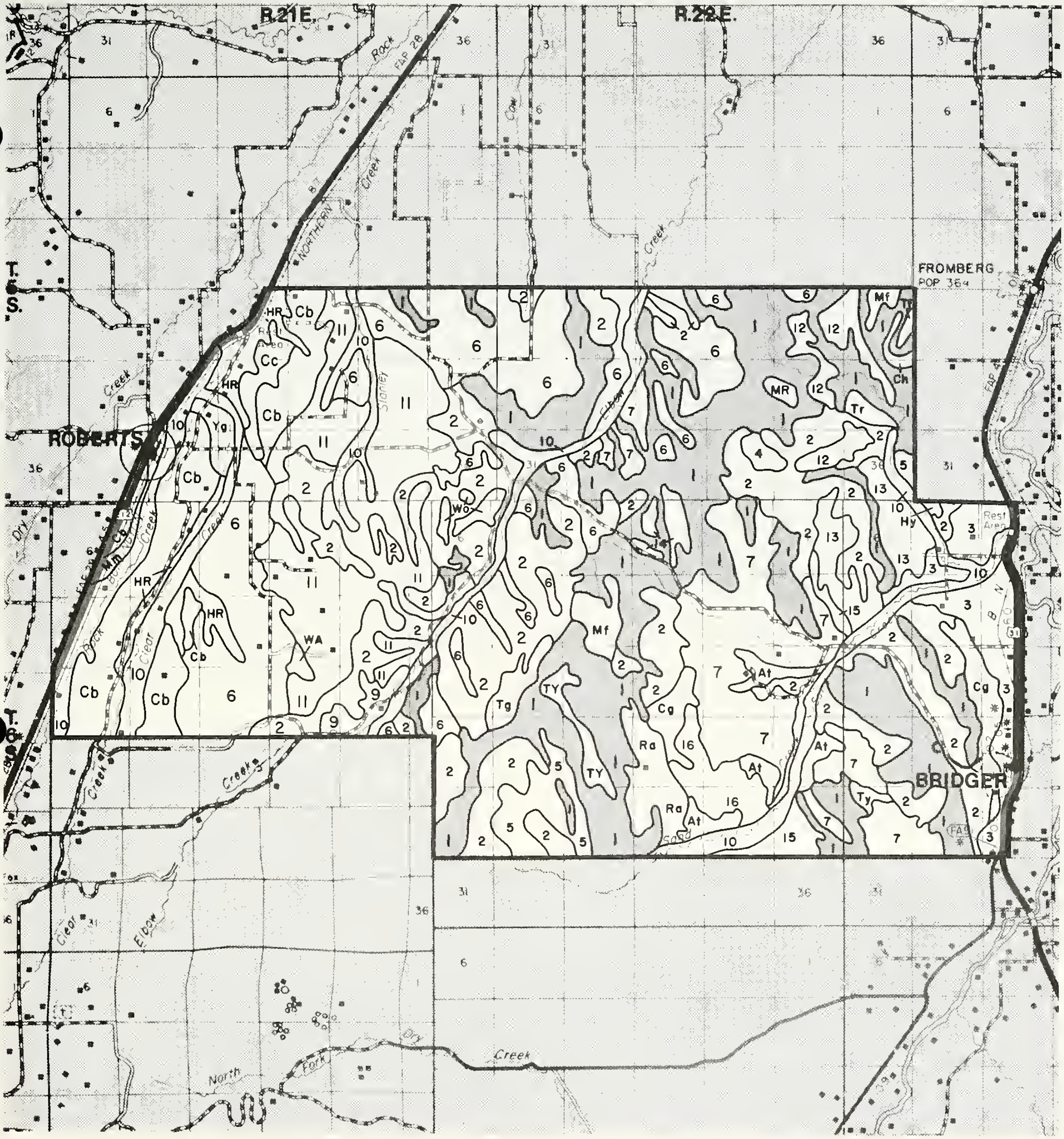
2. Soil Resources in the Study Area

The basic classificational or taxanomic unit in soil inventory work is the soil series. This level of classification represents a group of soils which have broadly similar characteristics and have developed from the same kind of parent material. The series level represents a rather broad grouping of soils and may be equated to a vegetative category such as pine trees which includes several species such as limber, lodgepole, ponderosa and white bark.

Each delineation on the soil inventory map contains a set of symbols within its boundaries. These symbols identify the mapping units which are described in Table III-3 and the appendix of this report. The kinds of soil individuals grouped into a mapping unit range from subdivisions of a series such as phases to combinations of series such as complexes and associations. The basic mapping units utilized in this study are soil associations. Definitions of soil series and associations are as follows:

> Soil Series
>
> A group of soils having soil horizons similar in differentiating characteristics and arrangement in the soil profile, except for the texture of the surface soil, developed from a particular type of parent material (Soil Survey Manual 1951).
>
> Soil Association
>
> A group of defined and named taxonomic soil units, regularly geographically associated in a defined proportional pattern. It is the principal soil mapping unit shown on all small scale maps (Soil Survey Manual 1951).

The basic mapping units were formed by combining the mapping units from more detailed large scale (1:20,000) soil survey sheets made available by the Soil Conservation Service. The inventory map is labelled Figure III-6. The components of the soil mapping units are presented in the technical appendix. General interpretative data for the associations and definitions of the mapping unit labels are located in Table III-3. Several recent changes have taken place in soil series nomenclature and those that are of importance in



SOIL ASSOCIATION

LEGEND FOLLOWS IN TABLE III-3

The data found on this map was transferred without assistance of optical reduction and should be utilized with caution.

BRIDGER TO ROBERTS
50 KV LINE

SCALE:

0 ½ 1 2 3 4 Miles

N

SOURCE:
Soil Survey Division 1975

FIGURE III-6

TABLE III-3

Management Interpretations for Soil Associations Recognized in the Bridger to Roberts Study Area

Soil Association	Principal Series	Land Use Cap. Classification*	Agricultural Uses
1	Sandstone and shale outcrop, Rentsac - Travessilla	VII and VIII	Very limited tonage production, principal use in wildlife and watershed management.
2	Midway - Wayden - Cabba - Castner - Travessilla	VI and VII	Limited forage production for grazing animals and marginal timber production.
3	Haverson - Heldt	II and III	Important agricultural cropland and irrigated/dryland hay crops
4	Travessilla - Ryle	III, IV and VI	Some cropland of good quality but includes some lands only suited to forage production.
5	Hydro - Allentine	II and III	Important agricultural cropland and irrigated/dryland hay crops.
6	Absarokee - Cabba Shane - Sinnigam	III and IV	Cropland suitability with portions requiring sophisticated management to maintain production and soil system.
7	Toluca - Colby Hydro	II, III and IV	Important agricultural cropland and irrigated/dryland hay crops.
9	Shane - Cabba Absarokee - Sinnigam	IV and VI	Limited cropland but relatively high forage production.

*dryland cropping capability classification could change with irrigation.

TABLE III-3 (cont'd.)

Soil Association	Principal Series	Land Use Cap. Classification*	Agricultural Uses
10	Heldt - Lohler Absarokee - Shane	III, IV and VI	Some cropland of good quality but includes some lands only suited to forage production.
11	Heath - Bynum - Shane Absarokee - Sinnigam	III and IV	Cropland suitability with portions requiring sophisticated management to maintain production and soil system.
12	Absarokee - Thedalund	IV and VI	Limited cropland but relatively high forage production.
13	Vona	II and III	Important agricultural cropland and irrigated/dryland hay crops.
14	Martinsdale - Alice Thiel	III, IV and VI	Some cropland of good quality but includes some lands only suited to forage production.
15	Travessilla - Colby Vona	III, IV and VI	Some cropland of good quality but includes some lands only suited to forage production.
16	Toluca - Travessilla Razor	II, III and IV	Important agricultural cropland and irrigated/dryland hay crops.

TABLE III-3

Individual Series/Complex Component Mapping Units

HR	Heath-Bynum association, steep
Cb	Charlos loam, 0-2% slopes
Cc	Charlos loam, 2-8% slopes
Wa	Wayden-Cabba association, hilly
At	Allentine clay loam, 2-4% slopes
Ch	Colby silt loam, 8-15% slopes
Tf	Thedalund clay loam, 8-15% slopes
Hy	Hydro silt loam, 4-8% slopes
Wo	Work clay loam, 4-8% slopes
Mf	Martinsdale clay loam, 2-4% slopes
Cg	Colby silt loam, 4-8% slopes
Ra	Razor clay loam, 2-8% slopes
MR	Midway-Travessilla association, hilly
TY	Travessilla silt loam, sloping
Tg	Thiel cobbly clay loam, 4-8% slopes

this study are presented in the technical appendix.

There are three major physiographic regions in the study area -- the steep residual uplands having shallow and very shallow soils, the relatively flat uplands which have moderately deep and deep soils, and the alluvial floodplains and terraces with deep, stratified and relatively fertile soils. The soils of each of these regions have individual capabilities and limitations. The soils of the steep uplands are critically important in maintenance of high quality watershed, wildlife habitat, and limited amounts of forage for livestock. These soils are generally highly erosive and disturbance of them results in extensive off site disruption. The rolling uplands, with their deeper soils, are important forage producers and are frequently utilized for cropland production where slopes permit. The bulk of the terrace and floodplain areas are irrigated and are important to the area, state, and nation for crop production. In light of their significant economic contribution, these soils should be preserved for crop production in the future.

2. Impacts of Proposed Action

There would be essentially no direct impact on the soil system from the construction of the proposed transmission line. However, secondary effects could be quite serious if mitigating measures are not adopted. Some of the secondary impacts potentially could include:

> Increased soil erosion during construction of the line due to disruption of the soil - vegetation system.

Changes in land and soil use from urban/suburban development related to the increased availability of electricity in Roberts and the area traversed by the proposed line

Increased potential for irrigation of new lands due to the increased availability of electricity

Continued and accelerated soil erosion from maintenance activities associated with the line

Loss of soil from production in areas associated with poles, maintenance facilities and substations

E. Vegetation

1. Resource Characteristics and Inventory

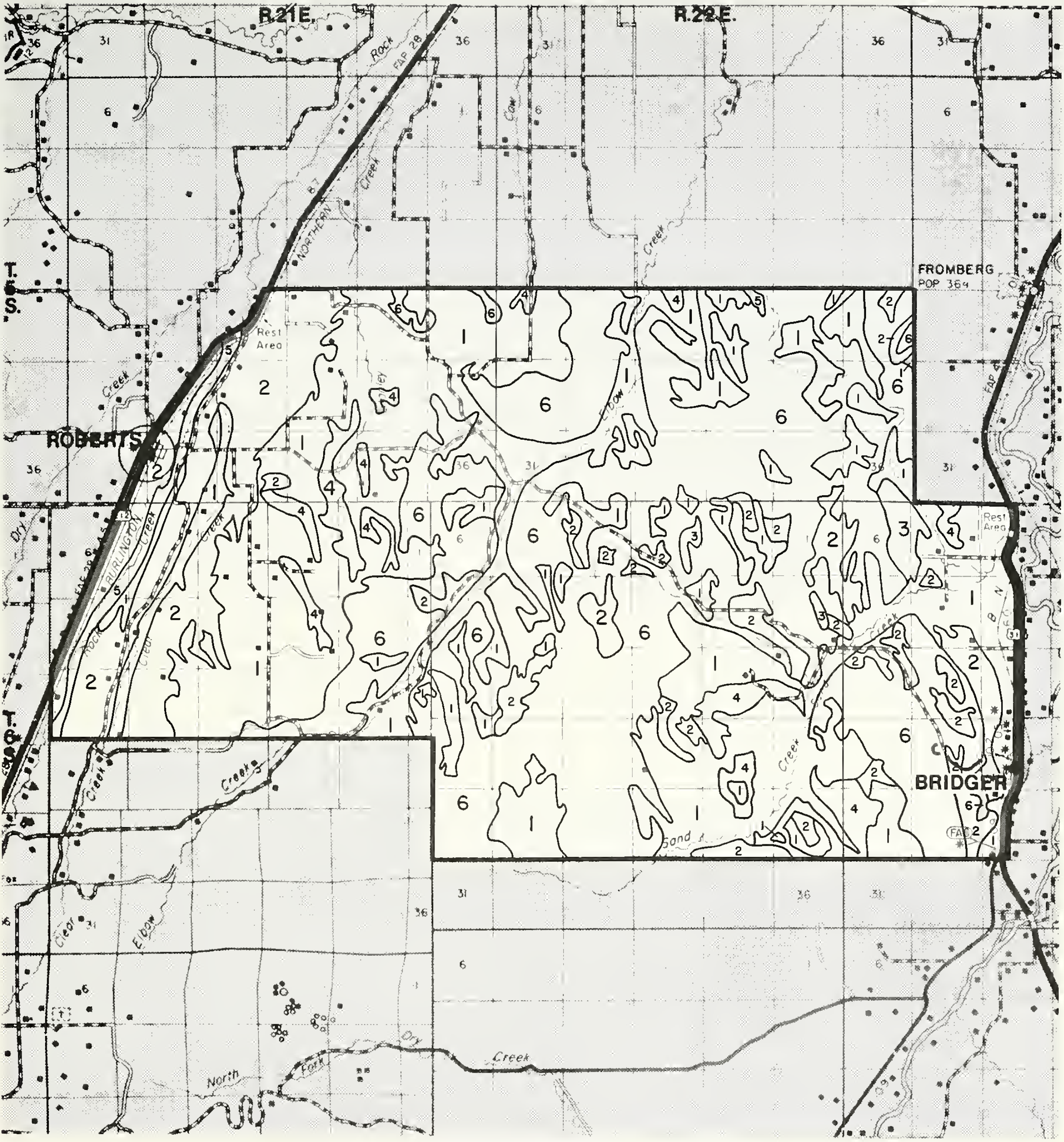
Soil Conservation Service range site technical guides were utilized in compiling the vegetation inventory of the study area. The soil survey mapping units were converted to range sites by considering a specific soil or group of soils with similar characteristics in a given precipitation zone to comprise a range site (Ross 1973). A range site in climax condition supports a native plant community that is typified by distinct kinds and/or amounts of vegetation. This vegetation may be classified in one of three categories: decreasers, increasers, or invaders. A decreaser is a plant species of the original vegetation that decreases in relative amount when the community is subjected to over-use. An increaser is a plant species of the original vegetation that increases in relative amount, at least for a time, when the community is subjected to over-use. An invader is a species that is absent in undisturbed portions of the original vegetation, but will invade under disturbance conditions or confined use (over-use).

Range sites indicate potential or climax vegetation which is the kind and amount of vegetation that a site is capable of supporting in an undisturbed situation. Therefore, range sites do not necessarily indicate the kinds and amounts of vegetation located on the site at the present time.

Eight different range sites, in two broad interpretative types of precipitation zones (10-14 inch and 15-19 inch), are present in the study area. These sites are designated as follows: clayey, dense clay, silty, sandy, shallow, shallow to gravel, thin breaks, and badlands. Technical descriptions of each site are presented in the technical appendix.

Some combination of range sites was necessary for mapping purposes. The following six mapping units are shown on the Range Site Map (Figure III-7):

Unit #	Range Site
1	clayey and dense clay
2	silty
3	sandy
4	shallow
5	shallow to gravel
6	thin breaks, shallow, and badlands



RANGE SITE

LEGEND

1 Clayey and Dense Clay
2 Silty
3 Sandy
4 Shallow
5 Shallow to gravel
6 Thin Breaks, Shallow, and Badlands

BRIDGER TO ROBERTS 50 KV LINE

N

SCALE:
0 ½ 1 2 3 4 Miles

SOURCE:
Adapted from Soil Survey of Carbon County, Montana— The scale of mapping and interpretative grouping was reduced without optical assistance and line placement is therefore subject to error.

FIGURE III-7

Table III-4 lists some of the important plant species and estimated total herbage production (climax) by range site and precipitation zone.

A list of plant taxa compiled by Tunistra (1967) for a small study along Rock Creek immediately south of Roberts appears in the technical appendix. This table gives some indication of the plant species present in the area, although no indication of distribution or importance is included. Representative vegetation types in the study area are shown in Figures III-8, III-9, III-10, and III-11.

2. Range Condition

Rangeland within the study area is generally in good to fair condition (McPhail 1975).

3. Impacts on Vegetation

a. Construction

Construction of the proposed transmission facility would create the most serious impact on vegetation. Much of the study area is composed of thin breaks and shallow range sites, the majority of which are located in the eastern half of the area almost entirely within the 10-14 inch precipitation zone. Construction of access roads across these sites could seriously affect the vegetation because of the numerous cliffs and steep slopes with relatively underdeveloped shallow soils. Vegetation cover in such areas is relatively sparce, and construction of roads would not only decrease the short term production of an already marginal area, but would also create a long term production decrease because of the difficulties inherent in revegetation of such sites. Permanent access roads would cause problems of increased soil erosion and nutrient

Table III- 4

No.	SCS Range Site	Precipitation Zone	Important Spp.	Production lb/acre
1	Clayey	10-14"	Green needlegrass Western wheatgrass	1200
		15-19"	Green needlegrass Western wheatgrass	2150
	Dense Clay	10-14	Winterfat Plains reedgrass	750
		15-19"	Winterfat Plains reedgrass	750
2	Silty	10-14"	Bluebunch wheatgrass Green needlegrass	1200
		15-19"	Bluebunch wheatgrass Green needlegrass	2150
3	Sandy	10-14"	Prairie sandreed Needle-and-thread	1200
		15-19"	Prairie sandreed Needle-and-thread	2150
4	Shallow	10-14"	Bluebunch wheatgrass Threadleaf sedge	750
		15-19"	Bluebunch wheatgrass Western wheatgrass	1800
5	Shallow to gravel	10-14"	Western wheatgrass Needle-and-thread	850
		15-19"	Western wheatgrass Bluebunch wheatgrass	1600
6	Thin breaks	10-14"	Bluebunch wheatgrass Western wheatgrass Ponderosa pine Limber pine Rocky Mountain juniper	650
		15-19"	Bluebunch wheatgrass Needle-and-thread	600
6	Shallow	10-14"	Bluebunch wheatgrass Threadleaf sedge	750
		15-19"	Bluebunch wheatgrass Western wheatgrass	1800
7	Badlands	10-14"	Prairie sandreed Alkali sacaton	

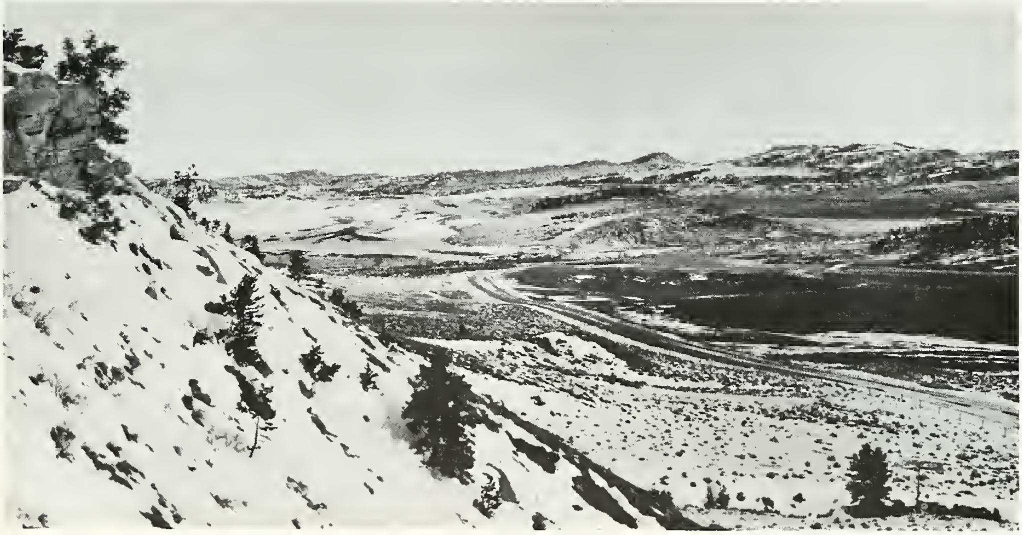


Figure III-8. Vegetation inhabiting the Eagle Sandstone cliffs approximately 1.5 miles northwest of Bridger includes limber pine, ponderosa pine, and Rocky Mountain juniper.

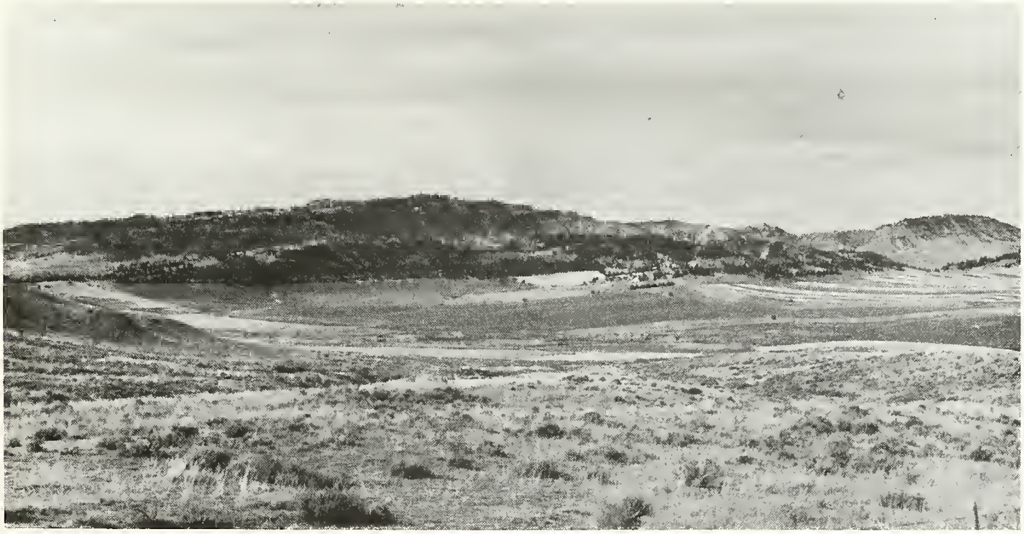


Figure III-9. Sagebrush grassland pasture, dry cropland and timbered escarpments are accented by a unique, solitary rock formation approximately four miles northwest of Bridger.

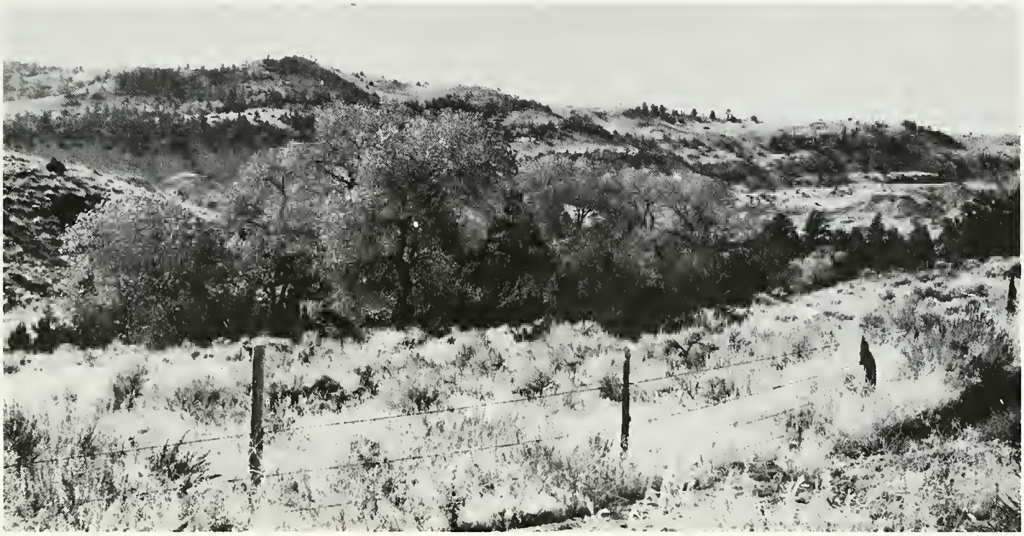


Figure III-10. Representative vegetation types found along Cedar Creek canyon include cottonwoods, ponderosa pine, limber pine and Rocky Mountain juniper. The sagebrush-grassland community in the foreground is dominated by big sagebrush and silver sagebrush.

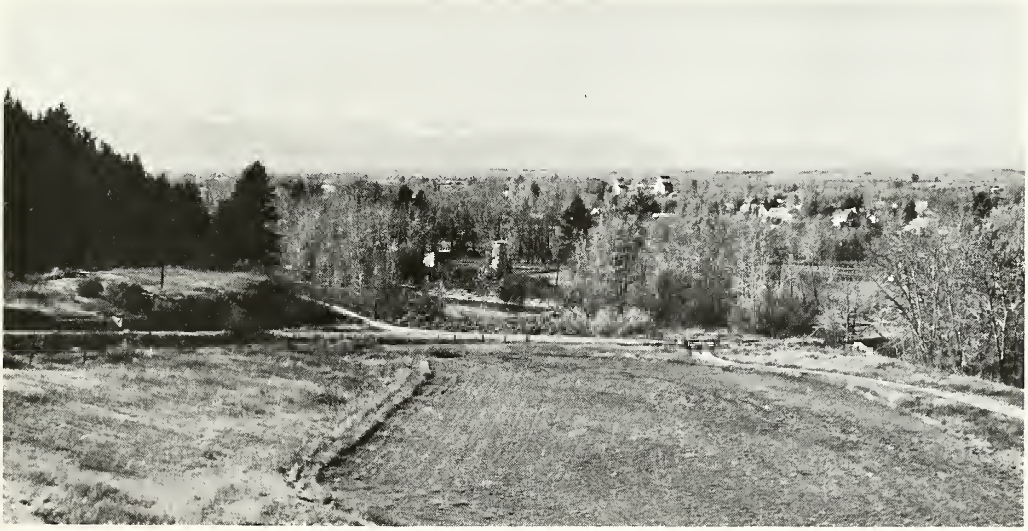


Figure III-11. Stands of cottonwoods grow on the alluvial floodplain of Rock Creek with a dense coniferous forest (including ponderosa pine and Douglas fir) lining the steep bank to the left. The town of Roberts is visible in the background.

loss. This could effectively add to the degradation of vegetation cover and productivity.

The coniferous trees (ponderosa pine, limber pine and Rocky Mountain juniper) in the area have little value as forest products (little possibility of economic return), but they are valuable as wildlife habitat and in watershed management. Tree removal inside the corridor would be necessary in order to construct the line and insure its reliability.

b. Operation

Impacts on vegetation resulting from operation of the transmission line would be minimal.

c. Maintenance

Vegetation impacts resulting from maintenance of the proposed line could be serious if excessive cross country travel occurs on sparsely vegetated, marginal range sites. Any additional stress on these sites could result in significant loss of production, accelerated soil erosion, and siltation of streams.

Cross country travel on the heavier clay soils during wet weather could result in deep ruts which would cause increased soil erosion, loss of herbage production, and sedimentation of streams.

F. Wildlife

1. Inventory

Terrestrial wildlife communities characteristic of semi-arid sagebrush-grassland, pine-juniper savanna, rocky escarpments, and riparian forests and shrubbery are found within the study area (see Figure III-12). Occasional montane species and wide-ranging predators associated with coniferous forests of the Beartooth and Pryor Mountains may wander through the area, but they cannot be considered residents. The study area is an important flyway for migrating birds that follow the eastern edge of the Cordilleran Rocky Mountains. Hunting and fishing pressure in the area is relatively high, and game species and furbearers provide an economic and recreational resource of local and regional importance. Erosion, competition with cattle, overgrazing, illegal shooting, and habitat alteration have been detrimental to wildlife populations in certain areas.

Mammals known to occur in the study area are listed in Table III-5, and several species of birds known from the area are listed in Table III-6. In addition to these species, most of the birds and mammals reported by South (1973) for the sagebrush-grassland, rock outcrop - forest, and streamside - hardwood ecosystems of the Pryor Mountains area probably exist within the study area. Figure III-13 shows a golden eagle nest discovered in the study area.

2. Impacts of Proposed Action

Construction and operation of a 69 KV transmission line may result in three types of impacts upon wildlife: displacement, increased mortality, and habitat alteration.

Temporary displacement of large ungulates, non-fossorial small mammals, and birds is to be expected during and following construction activities. Deer and pronghorns will avoid areas of heavy machinery operation and human activity during construction,

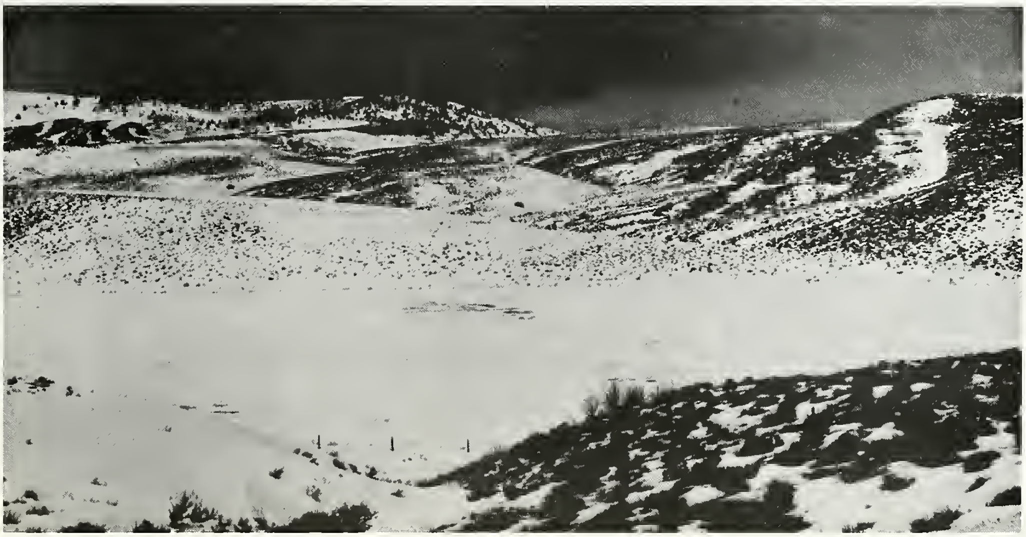


Figure III-12. A resident herd of antelope utilizes these sagebrush-grassland foothills seven miles west of Bridger, while mule deer utilize the pine covered ridges for forage and cover.

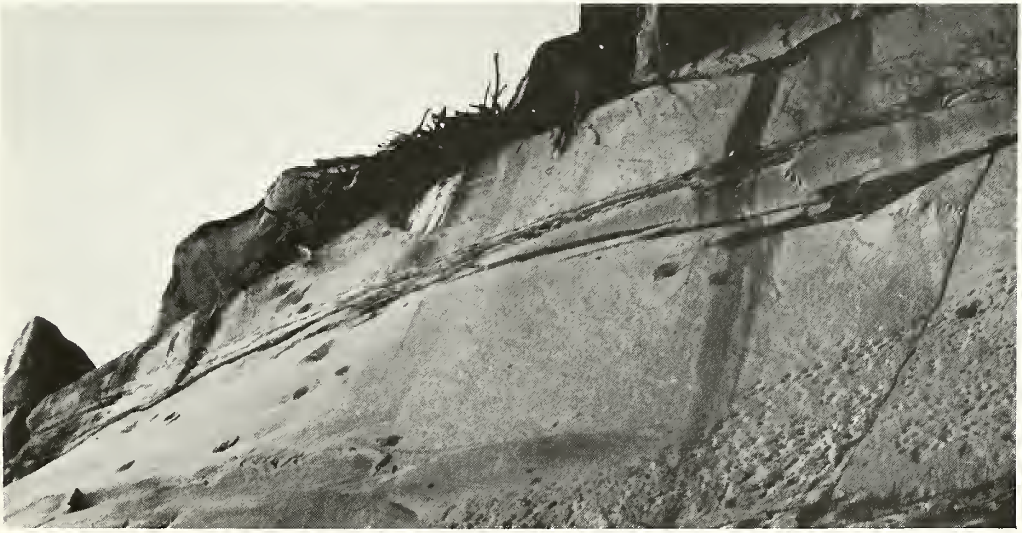


Figure III-13. Whitewash on the rock surface beneath this golden eagle nest on the Eagle Sandstone Cliffs indicates it may have been recently active. Other nests were found on the cliffs southwest of Bridger, but these probably represent supernumerary nests constructed by a single breeding pair.

TABLE III-5

INVENTORY DATA FOR MAMMALS KNOWN TO OCCUR IN THE BRIDGER-ROBERTS STUDY AREA.

Species	Habitat	Habit[1]	Classification[2]	Remarks	Sources[3/]
Mountain Cottontail (*Sylvilagus nuttallii*)	Shrubbery, forest edges, sagebrush	T	-	Common throughout the area; an important prey species for a number of predators. A dentary and partial skull were collected below a golden eagle nest near Bridger on 2/21/75	D. Judkins (1975)
White-tailed Jackrabbit (*Lepus* (*townsendi*)	Grassland, sagebrush	T	-	Common throughout the area	D. Judkins
Prairie dog (*Cynomys* sp.)	Grassland, sagebrush	FC	-	A dentary, possibly that of the black-tailed prairie dog, was found beneath a golden eagle nest on 2/21/1975	
Beaver (*Castor canadensis*)	Along rivers, lakes, streams	A	F	Frequently trapped along Rock Creek and the Clarks Fork; dams occur along Spring Creek. A valuable furbearer	D. Judkins (1975) Mont. F&G (1968)
Bushy-tailed Woodrat (*Neotoma cinerea*)	Rimrock, rock-slides, abandoned buildings	T	-	Common in the Eagle Sandstone cliffs near Bridger	pers. obs.
Prairie vole (*Microtus ochrogaster*)	Dry grassland sagebrush	F	-	Known to occur in an area three miles east of Bear Creek, Carbon Co.	Hoffman et.al. (1969)
Muskrat (*Ondatra zibethicus*)	Streams, ponds marshes	A	F	An important furbearer; frequently trapped along the Clarks Fork and Rock Creek	D. Judkins (197
Coyote (*Canis latrans*)	Grasslands, sagebrush, forests	T	P	Common in the study area; frequently trapped.	DeVries (1974) Compton (1975) Denton (1974)

TABLE III-5 (con't)

Red Fox (Vulpes fulva)	Grassland, riparian shrubbery	T	-	Frequently trapped along Rock Creek and the Clarks Fork	D. Judkins (1975)
Black Bear (Ursus americanus)	Coniferous forest	T	G	A rare visitor to the study area; one was killed between Bridger and Roberts in 1974	DeVries (1974) D. Judkins (1975)
Raccoon (Procyon lotor)	Riparian woodlands	TR	-	Frequently trapped; has increased in abundance in recent years	DeVries (1974) D. Judkins (1975)
Short-tailed weasel (Mustela erminea)	Streambanks, esp. in coniferous forests	T	P	Occasionally trapped along the Clarks Fork	D. Judkins (1975)
Long-tailed weasel (Mustela frenata)	Various; usually near water	T	P	Common throughout the study area	D. Judkins (1975)
Mink (Mustela vison)	Along rivers, lakes, streams	A	F	Common along Rock Creek and the Clarks Fork	D. Judkins (1975)
Badger (Taxidea taxus)	Dry grassland, sagebrush	F	-	Known from the vicinity of Cedar Creek within the study area	D. Judkins (1975)
Western spotted skunk (Spilogale gracilis)	Rocky semi-deserts	T	P	Trapped near Bridger; the study area lies along the extreme northern edge of the range of this species.	Denton (1974) D. Judkins (1975)
Striped Skunk (Mephitis mephitis)	Riparian woodland agricultural areas	T	P	Common along major drainages	D. Judkins (1975)
Mountain Lion (Felis concolor)	Remote mountainous areas	T	G	A rare visitor to the study area	D. Judkins (1975)

TABLE III-5(con't)

Bobcat (*Lynx rufus*)	Various	T	P	Frequently trapped along the Clarks Fork.	D. Judkins (1975)
Elk (*Cervus canadensis*)	Coniferous forests and adjacent sagebrush and grassland areas.	T	G	Occasional individuals from the nearby mountains wander through the study area.	D. Judkins (1975)
Mule Deer (*Odocoileus hemionus*)	Forests, grassland, sagebrush	T	G	Found throughout the study area; concentrate in the coulees near Bridger, the Cedar Creek Canyon, and the wooded ridge between Sand and Elbow Creeks.	Denton(1974a) Compton(1975)
White-tailed Deer (*Odocoileus virginianus*)	Riparian woodlands and adjacent agricultural areas.	T	G	Resident along Rock Creek and the Clark's Fork; much less common than the preceding species.	Compton (1975
Moose (*Alces alces*)	Coniferous forest; willows	T	G	A rare visitor to the study area; seen along Rock Creek near Roberts as recently as 1970.	DeVries (1974
Pronghorn (*Antilocapra americana*)	Sagebrush, grassland	T	G	A herd of 150-200 resides between the pine-clad ridges and the valley of Elbow Creek. Damage to crops attributed to antelope has been reported from the Elbow Creek area.	Compton (1975 Denton (1974a Compton (1975
Mountain Sheep (*Ovis canadensis*)	Coniferous forests, grasslands, ridges	T	G	Individuals from the 1971 and 1974 Pryor Mt. transplants have been sighted in the study area and are probably transient; however, a few may linger in the rims along the Clark Fork Valley or on the pine ridge between Sand and Elbow Creeks.	Denton (1974a Compton (1975 Gordon et.al. (1974)

1/ F=fossorial(burrowing); T=terrestrial or partially fossorial; A=aquatic or semi-aquatic; R=arboreal; C=colonial
2/ G=game animal; P=predator; F=furbearer (as classified by the Montana Department of Fish and Game, 1974).
3/ Hall and Kelson (1959), Hoffmann et.al. (1969), and Hoffmann and Pattie (1968) were used as sources throughout. Additional sources pertaining to local abundance and distribution are listed.

Table III-6

INVENTORY DATA FOR SEVERAL SPECIES OF BIRDS KNOWN TO OCCUR IN THE BRIDGER-ROBERTS STUDY AREA

Species	Habitat	Classification1/	Remarks	Sources2/
Great blue heron (*Ardea herodias*)	Riparian woodlands, shores of lakes, rivers.	-	Rookeries were once found along the Clark's Fork near Bridger but have been destroyed by recent gravel pit operations.	Strickland (1975)
Golden eagle (*Aquila chrysaetos*)	Cliffs, prairies, canyons	-	Relatively common breeders in the area; possibly approaching breeding densities of one pair per 75 square miles as reported by McGahan (1968) for the Livingston, Montana area. Strickland (1975) has located and photographed several active nests south and east of Joliet, and Don Judkins (1975) described nesting activities near Bridger. Five nests were located within the study area on February 21, 1975 on the Eagle Sandstone cliffs in the "Big Hills" just west of Bridger. Several of these undoubtedly represent supernumerary nests constructed by a single breeding pair. One of the nests, located along the county road one mile northwest of Bridger, is shown in Figure III-13. Remains of mountain cottontail and prairie dog were found beneath this nest. Local children have been known to shoot at the eagles and destroy nests.	McGahan(1968) Strickland (1975) D. Judkins(1975)
Bald eagle (*Haliaeetus leucocephalus*)	Near lakes and rivers	-	Wintering individuals have been seen along Rock Creek near Joliet	McPhail(1975) Strickland (1975)
Prairie falcon (*Falco mexicanus*)	Canyons, prairies, deserts	T	Reported from the Bridger area	Denton(1974a)
Peregrine falcon (*Falco peregrinus*)	Open country	E	This portion of the Big Horn Basin may be a flyway for flocks wintering in Wyoming. At 8:45 a.m. on February 21, 1975, a male was observed on the Eagle Sandstone cliffs in the "Little Hills" about one-half mile west of	

Table III-6 n't)

			Bridger by Larry Thompson and Gary Judkins. The bird flew from a canyon and perched, facing away, on the rim of a wooded cliff about 100 feet from the observers. The large size, blue-gray color, and distinctive facial pattern were clearly indentifiable to both observers with the naked eye but were verified with Bushnell 7x35 binoculars. The bird flew beyond view following approximately two minutes of observation.	Denton(1974
Ruffed grouse (Bonasa umbellus)	Coniferous forests	G	Found along upper Rock Creek above Red Lodge; may extend into the study area near Roberts.	Denton(1974
Sharp-tailed grouse (Pedioecets phasianellus)	Prairie, thickets, forest edges	G	Uncommon and local in the study area.	Denton(1974
Sage Grouse (Centrocercus urophasianus)	Sagebrush plains	G	Relatively common in sagebrush areas along upper Elbow Cr. Known strutting grounds 8 mi. south of Bridger.	Denton(1974 D. Judkins (1975)
Ring-necked pheasant (Phasianus colchicus)	Riparian Shrubbery, agricultural land	G	Found along Rock Cr., Elbow Cr., and the Clarks Fork and adjanct agricultural areas. Brood sizes in Carbon County in 1973 were Below the long-term average.	Denton(1974
Chukar partridge (Alectrois graeca)	Arid slopes, canyons	G	Rare and local; probably occur only along the Eagle Sandstone cliffs west of the Clarks Fork	Compton (1975)
Gray partridge (Perdix perdix)	Grain fields, open farm	G	Abundant throughout the study area	Compton(197 Denton(1974 Judkins(197

1/ T = Threatened; E = Endangered (as classified by the U.S. Bureau of Sport Fisheries and Wildlife, 1973), G = upland game birds (as classified by the Montana Department of Fish and Game, 1974).

2/ Peterson (1969) was used as a source for habitat information. Additional sources pertaining to local distribution and abundance are listed.

but will return once construction is completed. There is no evidence that these mammals avoid operating 69 KV transmission lines. Breeding birds, notably raptors, may abandon nests if disturbed excessively by machinery and large numbers of workmen. Sage and sharptail grouse may abandon display grounds if construction occurs nearby.

Increases in mortality rates of some species may result from construction and operation of transmission lines. Fossorial mammals and small birds nesting in the immediate vicinity of pole-drilling sites would be destroyed. However, due to the characteristic high natural mortality and high reproductive rates of these species, this impact would be negligible, except in the case of highly colonial species such as the prairie dog. The design of poles and conductors makes electrocution of large raptors perching on poles unlikely. Some bird mortalities may result from wire strikes, but in the absence of large concentrations of breeding waterfowl, this possibility may be considered insignificant. Important increases in mortality may result from illegal shooting of large raptors by construction crews and by local residents shooting at raptors perched on the poles. Major population changes may result from small increases in mortality because of the low reproductive potential of these birds.

Habitat alteration caused by the construction and operation of a 69 KV transmission line in the study area is expected to be insignificant. Temporary or permanent access roads would result in greater habitat destruction than roadless construction methods. Significant and permanent habitat alteration may result from an increase in housing units associated with increased power availability in this sparsely settled area.

G. Fisheries and Associated Aquatic Biota

1. Inventory

a. Fisheries

A variety of sport fish, including rainbow trout (Salmo gairdneri), cutthroat trout (Salmo clarki), brook trout (Salvelinus fontinalis), brown trout (Salmo trutta), and mountain whitefish (Prosopium williamsoni) inhabit permanent streams within the study area. In addition, several species of non-sport fish, including longnose sucker (Catostomus catostomus), white sucker (Catostomus commersoni), mountain sucker (Catostomus platyrhynchus), longnose dace (Rhinichthys cataractae), lake chub (Couesius plumbeus), flathead chub (Hybopsis gracilis), carp (Cyprinus carpio), and shiners occur in or near the area. The fisheries in and near the study area, as well as local sedimentation problems, will be discussed for each major stream.

1. Clarks Fork

Prior to 1924, trout and whitefish appeared in the Clarks Fork as far down stream as Fromberg. However, at present trout and whitefish are seldom caught below Belfry. This decline in sport fish has been attributed to increases in sedimentation (DNRC 1973). Burbot (Lota lota), sauger (Stizostedeon canadense), and goldeye (Hiodon alosiodes) occur in the lower Clarks Fork, but it is not known if they extend as far upstream as Bridger (DNRC 1973). Electrofishing of the Clarks Fork south of Belfry in the summer of 1973 showed an abundance of mountain whitefish with good reproduction and a wide size range (6-14 inches). Longnose suckers, white suckers, and a single rainbow trout were also taken. Fair numbers of rainbow and cutthroat trout are reportedly taken in winter (Bishop 1975).

2. Rock Creek

Rock Creek south of Roberts has been intensively studied as part of a continuing investigation of the effects of erosion of fisheries (Nelson 1958; Nelson and Hill 1960; Tuinstra 1967). Gunderson (1968) and Marcuson (1971) compared fish populations in the ungrazed and overgrazed areas described by Tuinstra (1967). The results of Marcuson's study (1971) are presented in Table III-7. The "natural area" measured in the tables was an ungrazed section which had been purchased by the Montand Department of Fish and Game and fenced to exclude livestock. The overgrazed area displayed noticeable channel instability, greater erosion due to flooding, vegetative differences, and a reduced capacity to support fish.

Marcuson (1971) found the standing crop of brown trout in the natural area to be over three times by weight and two times by number per acre higher than in the overgrazed area. Greater weight per acre was apparent in all size classes. Gunderson (1968) found greater numbers and weights per acre in the natural area for all size classes of brown trout except 2-3.9 inch fish. Brown trout over 14 inches were captured at a rate of 5.5 per 1000 feet of stream in the natural area; the largest was 20 inches in length and weighed 3.01 pounds. In the overgrazed area only 1.7 brown trout over 14 inches were taken per 1000 feet of stream, the largest measuring 18.8 inches and 2.41 pounds. Scale analysis showed no apparent differences in growth rate of brown trout between areas.

Table III-7 Estimated brown trout population in the natural and overgrazed areas of Rock Creek. Confidence intervals at 95% level.

Size Group (inches)	Overgrazed			Natural		
	No./Acre	Wt/Acre	Avg Wt	No./Acre	Wt/Acre	Avg Wt
2.0 - 4.9	378	7.56	0.02	793	15.86	0.02
5.0 - 8.0	220	19.80	0.09	774	69.66	0.09
8.1 - 10.5	78	20.28	0.26	208	56.16	0.27
10.6 - +	25	15.75	0.63	105	71.40	0.68
Total	701	63.39		1,880	213.08	
Conf Intv (±)	(304)			(673)		

(Marcuson 1971)

Estimates for all other fish species in the natural and overgrazed areas of Rock Creek.

Species	Overgrazed		Natural	
	No./Acre	Wt/Acre	No./Acre	Wt/Acre
Rb[1/]	48	4.32	19	3.61
Eb	5	0.57	3	0.03
MWf	170	39.44	41	33.62
MSu	144	8.06	56	73.92
FSu	-	-	76	10.64
Total	367	52.39	195	121.82

(Marcuson 1971)

[1/] Rb = Rainbow trout; Eb = Brook trout; MWf = Mountain whitefish; MSu = Mountain sucker; FSu = Longnose sucker.

Measurements of other fish species show greater numbers but less than half the standing crop in pounds per acre in the overgrazed area. Juvenile mountain whitefish were found only in the shallow shoal areas characteristic of the overgrazed area. No juvenile whitefish were captured within the natural area, although adult whitefish preferred natural area habitats. No longnose suckers were captured in the channel of the overgrazed area. Natural area waters yielded 73.92 pounds per acre (Marcuson 1971).

The USDA channel clearance and realignment program in 1958 seriously reduced the amount of fish habitat and fish numbers in Rock Creek by making the stream shorter, wider, and more shallow. Excessive erosion continues to adversely affect fish populations (Marcuson 1971).

3. Clear Creek

Clear Creek provided a modest sport fishery, including some brown and brook trout, prior to the planting of catchable rainbow trout in 1964. Fishing in the stream is now considered good (Marcuson 1967), and the stream receives heavy fishing pressure (Bishop 1968, 1975). A summary of three years of electrofishing data is presented in the technical appendix.

Bishop (1968) found Clear Creek to be in poor condition for successful spawning because of heavy siltation caused by irrigation runoff. Trout recruitment was poor; few trout less than six inches long were caught and most were six inches or longer. The seven rainbow trout taken, all from the lower section of the creek, were probably remnants of a 1966 plant of catchables.

4. Spring Creek

This tributary to Willow Creek, located several miles southwest of the study area boundary, was electrofished on July 2, 1968. Mountain whitefish, white suckers, brown and brook trout were found below the beaver dams, while only brook trout were found above the dams.

5. Bluewater Creek

Brown trout and rainbow trout are the only salmonids found in Bluewater Creek (Bianchi 1963). Other fish include longnose dace, flathead chub, plus mountain, white and longnose suckers. Trout/rough fish ratios were found to have improved significantly between 1963 and 1968 due to habitat improvement and an up to 52% reduction in sediment load. The average weight of 95 brown trout taken was 0.41 pounds and 80% were over seven inches in length (Marcuson 1969).

Sedimentation due to agricultural practices is a serious problem in this area. Bianchi (1963) and Peters (1962, 1963, 1967, and 1971) found salmonids to be much more abundant in the upper portion of the stream above areas of intensive agriculture.

b. Aquatic Insects

Zillges (1971) investigated the benthic macroinvertebrate fauna of Bluewater Creek, which is probably representative of similar streams within the study area. Twenty-six taxa were collected on the lower Bluewater Creek near the Clarks Fork. Diptera were numerically dominant in bottom and day-drift samples. Forty-two taxa were collected at another station a few miles upstream, but above the area of most intensive agriculture. Ephemeroptera were dominant in this upper station, and much greater numbers of Plecoptera and Coleopptera were found than in the lower section.

2. Impacts of Proposed Action

The most important impacts which the construction and operation of a 69 KV transmission line would have upon aquatic ecosystems in the study area are those associated with sedimentation of streams resulting from road construction and/or off-road movement of heavy equipment. Siltation of streams is already a problem in and near the study area, and has been shown to be detrimental to sport fish and aquatic insects (DNRC 1973; Marcuson 1969 and 1971; Peters 1971; Bishop 1968).

Adult trout can tolerate moderate amounts of suspended sediment for a short time. The most detrimental effect of siltation upon trout populations results from harm to eggs and developing embryos. Silt fills the gravel interstices in stream beds, depriving the developing eggs of oxygen and allowing toxic waste products to accumulate (DNRC 1973; Bianchi 1963). Similarly, siltation destroys habitat for many species of benthic macroinvertebrates upon which trout are dependent for food, and can destroy large numbers of aquatic insects by eroding or plugging delicate gill tissues (DNRC 1973; Zillges 1971).

Clearing of streambank vegetation and installation of culverts could also result in negative impacts upon aquatic ecosystems (DNRC 1973; Marcuson 1971).

IV CULTURAL CHARACTERISTICS AND IMPACTS

A. Cultural Characteristics

1. Existing Land Use

a. Agriculture

Land use in the study area demonstrates that agriculture is the primary industry in Carbon County (Beartooth RC&D 1970, p. 43). Dry cropland and grazing land dominate the upland region between Bridger and Roberts, and irrigated lands are primarily located adjacent to the Yellowstone River and Rock Creek on the respective eastern and western boundaries of the study area. Agricultural land uses also respond directly to the physiography with grazing areas confined to lands too steep for machinery and more intensive crop production. The eastern half of the study area is topographically diverse, intermittently dissected by drainage patterns which contribute to either Sand or Elbow Creek, and primarily used for grazing livestock; the western portion, having larger expanses of flat terrain, is used for dry crop farming (wheat and other small grains), hay production, and grazing.

Irrigated fields are necessarily located near reliable sources of water, i.e., the Yellowstone River, Rock Creek, and emanating ditches (see Figure IV-1). However, improved irrigation equipment is diminishing the need for close proximity to water.

b. Transportation

The streams mentioned above not only define the boundaries of irrigated lands, but are also the north/south axes of the principal transportation corridors for highways and the Burlington/Northern railroad. U.S. Routes 212 and 310 connect northwest Wyoming with Interstate 90 in Montana. In 1972, Route 212 carried an average of 1440 vehicles a day, and Route 310 an average of 1820 vehicles through Bridger. The railroad rights-of-ways are adjacent to these highways (see Figure IV-2).

The interior portion of the study area is serviced by a net work of graded roads that are essentially aligned east and west. There is no shortage of access within the study area for two axle vehicles.

c. Residential Patterns

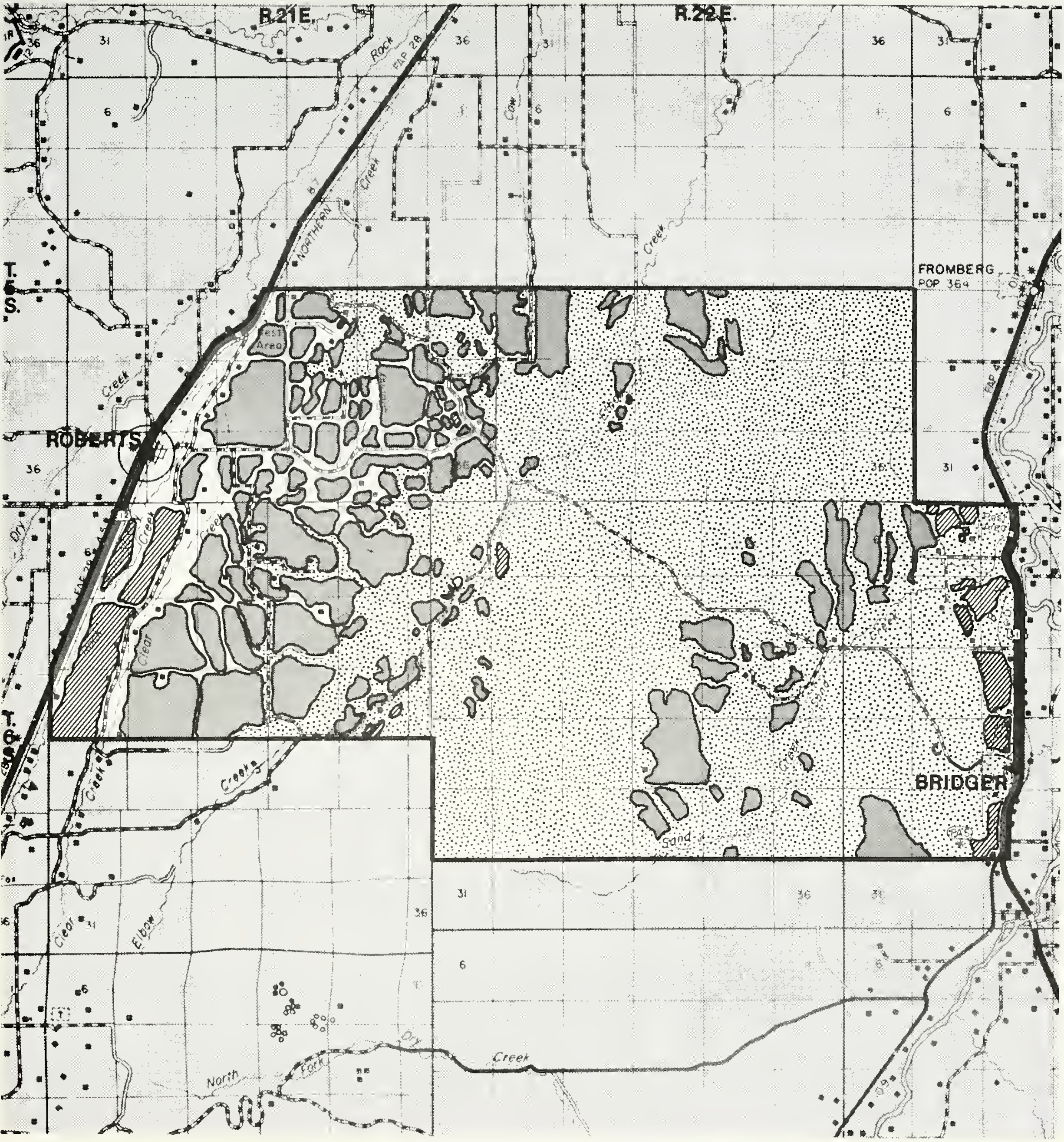
A majority of the local residents are also located along the waterways in either Roberts or Bridger (see Figure IV-3). The upland region between these two towns contains a few scattered residences, farms, and ranches, but the more accessible valley areas contain most of the permanent homes. Residential expansion has been along established transportation routes, water amenities, and existing communities.

d. Utilities

Transmission and distribution lines, (see Figure IV-2) operated by the Montana Power Company and Beartooth R.E.A., follow the settlement pattern of the area and are therefore predominately located in the valleys of the Yellowstone River and Rock Creek. At present Roberts receives its power from the Edgar substation via a distribution line system through Boyd, Montana.

e. Recreation

Recreation sites, such as fishing access roads, picnic spots and swimming areas are concentrated along the waterways with six



MAP OF THE CURRENT LAND USE PATTERNS

LEGEND

▨ Irrigated Land

■ Dry Crop Land

░ Grazing Land

☐ Multi-Use Land

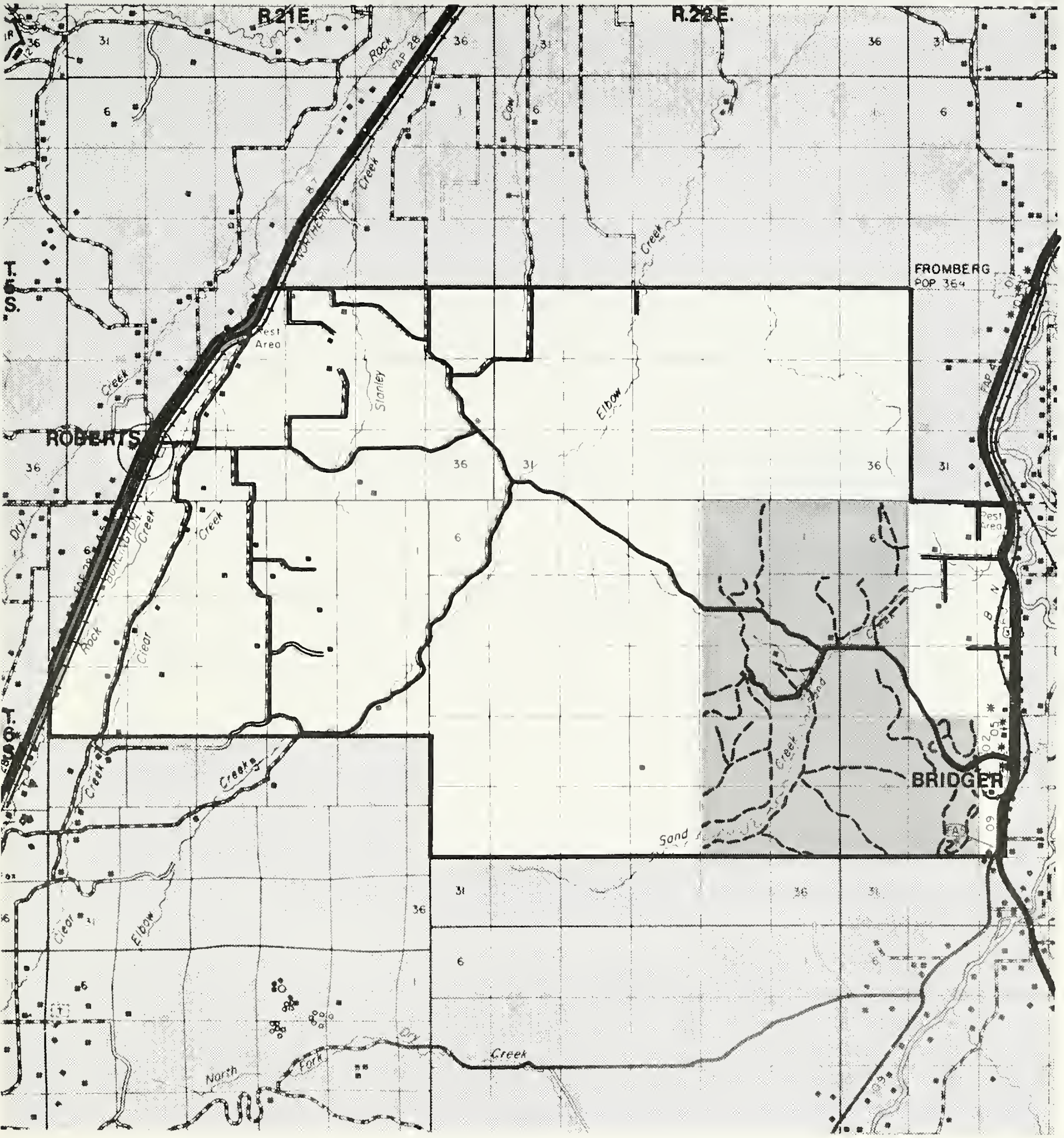
BRIDGER TO ROBERTS
50 KV LINE

SCALE:
0 ½ 1 2 3 4 Miles

N

SOURCE:
ASCS Aerial Photography 1972

FIGURE IV-1



BASIC TRANSPORTATION ROUTES
with detailed analysis of a selected area

LEGEND

- +—+—+ Railroads
- ━━ Paved Highway
- —— Graveled
- ═══ Unsurfaced
- — — — Primative
- ▨ Sample Area Only

BRIDGER TO ROBERTS
50 KV LINE

SCALE:
0 ½ 1 2 3 4 Miles

SOURCE:
ASCS Aerial Photography 1972,
Montana Highway Department 1975

FIGURE IV-2

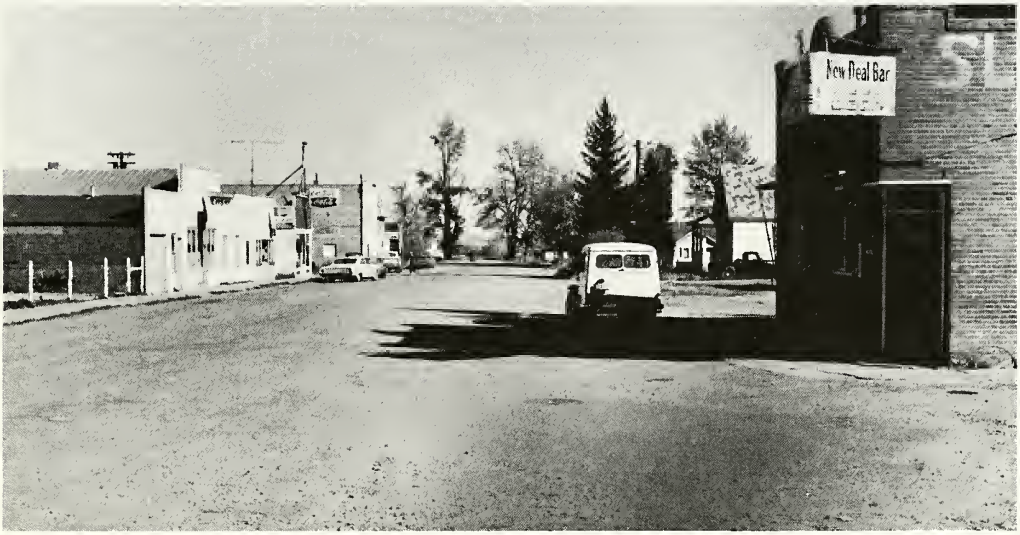


Figure IV-3. The town of Roberts, Montana

sites along Rock Creek between Roberts and Red Lodge, and one site at Bridger on the Yellowstone River. Proximity to the Custer and Gallatin National Forests provides quick access to large, public land areas for dispersed forms of recreation, i.e., hunting, backpacking, snowmobiling, etc.

Carbon County is experiencing a growing recreational demand in both winter and summer because of its location near mountainous terrain and its proximity to Billings. Red Lodge Mountain ski area is becoming a major attraction which balances the summer influx of recreationists.

2. Land Ownership

Private land ownership dominates the study area except for scattered partial sections of Bureau of Land Management and State of Montana lands. Ownership is normally not a constraint to corridor alignment unless there are established legal restraints.

3. Historic and Archaeologic Sites

The most important historic element in the study area (see Figure IV-4) is a portion of the Bridger Trail. This route was pioneered in 1864 by Jim Bridger and was used as a cutoff from the Oregon Trail until the 1890's. It has not been exploited as a local attraction, nor given special land use attention other than inclusion in the Montana Historic Sites Compendium.

4. Unique Features and Visual Attractions

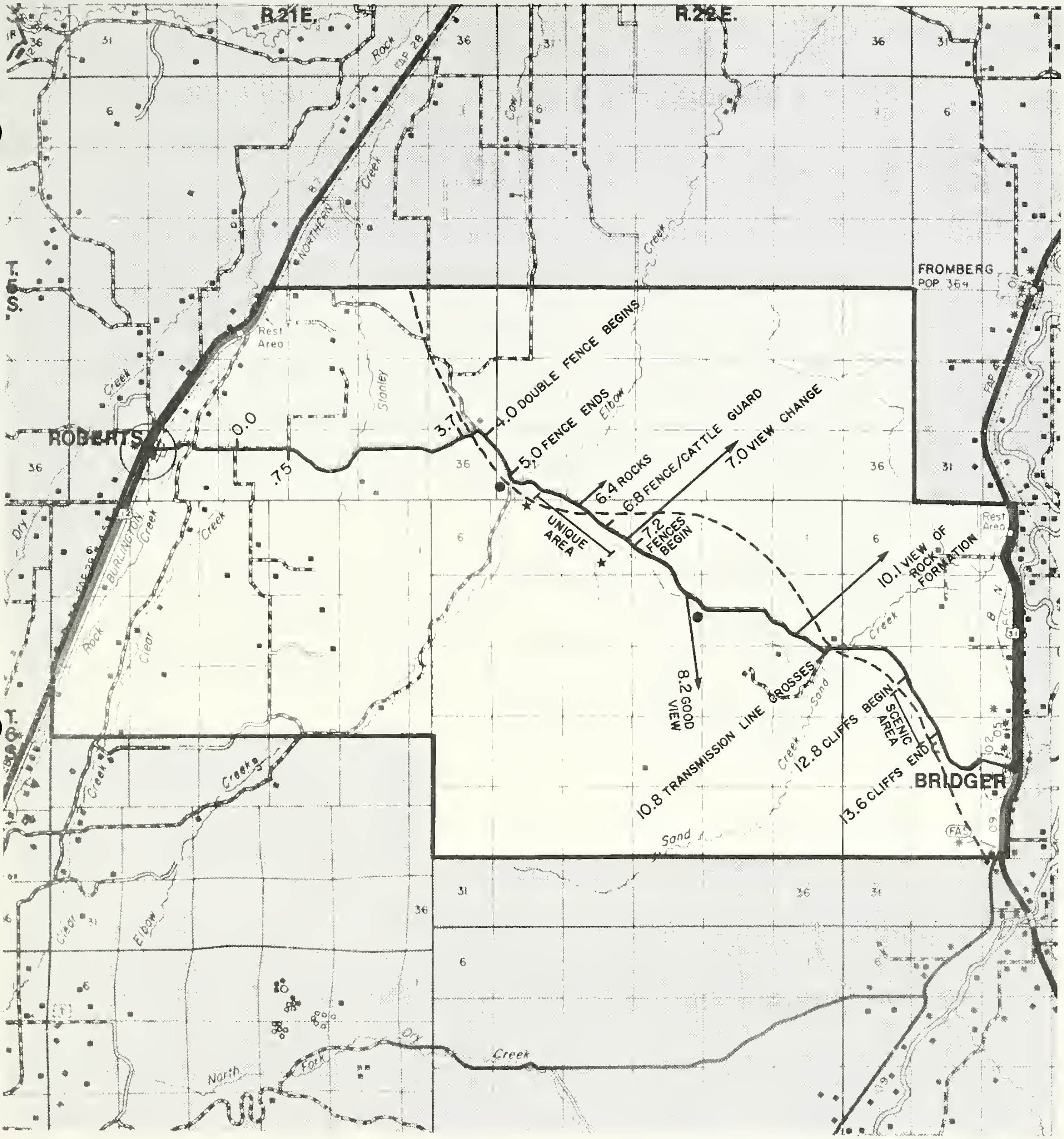
A primary ingredient in the sensory stimulation that results in a feeling of beauty or general attractiveness is based on contrast. The Yellowstone River and Rock Creek valleys accommodate not only the water ways, but also roads, utility lines, and habitation structures, and, in essence, are the human activity corridors of the study area. In contrast to these zones, the interior part of the study area (see Figure IV-4) is virtually uninhabited, undeveloped (except for a graded road) and unencumbered by structures such as telephone poles and fence lines. The area is unique relative to adjoining areas, and therefore serves as an attraction which features unusual rock formations and other focal points. Figure IV-4 locates the prime area (between the stars) and the preferable buffer zone (located between the black dots). The rough topography offers a unique landscape that is in strong contrast to the lands at the eastern and western ends of the study area and a harmonious foreground to the mountains southwest of the study area (see Figures V-2, V-3 and V-4).

This non-developed area has the potential for increased landscape contrast to the more developed areas. The degree of contrast will always be relative to the extent of man's influence on the landscape. Rough topography partially projects this land from development, but such topography can also serve as an attraction for residential development. This unique land area is presently an amenity on an undeveloped road which is not heavily used. These qualities make it especially valuable for the future.

5. Population

a. Trends

The Carbon County population has been recorded by the U.S. Census Bureau. Requirements of residency duration and type



VISUAL RESOURCES

LEGEND

● Buffer Zone
—— County Road
------ Bridger Historic Trail
←—— Significant Views
★ Unique Visual Resource
— Approximate Mileage Indicator

BRIDGER TO ROBERTS
50 KV LINE

SCALE:
0 ½ 1 2 3 4 Miles

N

FIGURE IV-4

of residency, primary or secondary, establish a small margin of error in determining the number of permanent residents. These figures, taken over time, can be used to determine population trends. They can also be used in coordination with birth and death rates and migration assumptions to project future population. As a planning tool, the estimates are helpful guidelines for evaluating growth policy and providing a rough schedule for initiating capital improvements and other community services programming. However, as with any future prediction, the figures are very susceptible to unpredictable influences.

The following figures (Table IV-1) are for Carbon County but they would also apply to the study area at a reduced level. The Roberts area would probably demonstrate a higher rate of growth due to its location near Red Lodge and a major road linking Red Lodge to Interstate 90.

TABLE IV-1

Population Trend

Year	Carbon County Population*	Percent Change
1940	11,865	Base
1950	10,241	-13.7%
1960	8,317	-18.8%
1970	7,080	-14.9%
1971	7100	+0.3%
1972	7500	+5.6%
1973	7800	+4.0%

Source: IGR 1974

* Figures through 1970 represent actual census count; 1971, 1972 and 1973 figures are estimated population based on births, deaths and interstate and regional migration

Four alternative population projections, based on four different migration assumptions, are shown in Table IV-2.

TABLE IV-2

Carbon County Population Change Scenarios

Scenario	A		B		C		D	
Year	1975	1980	1975	1980	1975	1980	1975	1980
Population	6495	5838	6975	7109	6795	6633	6202	5051

Scenario Assumptions

A. Continued 1960-1970 migration trend until 1980

B. No net migration from 1970 to 1980

C. 50% decrease in 1960-1970 trend applied to 1970-1980 decade

D. 50% increase in 1960-1970 trend applied to 1970-1980 decade

Source: IGR 1974

A comparison of Tables IV-1 and IV-2 indicates that there has been a drastic change in the long term trend of population in Carbon County.

Another estimate, related to population trend, is presented below in Table IV-3. This estimate includes only the Beartooth R.E.A. service area and represents customers (meters) and therefore would include public buildings, businesses, and second homes.

TABLE IV-3

Beartooth REA Consumer Forecast

Year	1971	1975	1980	1983
Total Consumers	2,366	2,765	3,300	3,621

Source: Beartooth REA Financial Forecast 1974

The growth shown in the above table is based on a yearly constant increase factor of about 3% in the number of meters.

b. Population Characteristics

Census figures quantify existing population, but populations vary along dimensions other than numerical size. The Carbon County population is abnormally fragile with respect to both age structure and income. The following median age figures reveal a substantially older population in Carbon County than is common in the rest of the state.

TABLE IV-4

Median Age of Population

Median Age	1960	1970
Montana	27.6	27.1
Carbon County	35.5	39.8
Red Lodge	N.A.	51.5

Source: Carbon County Planning Office 1974

The 39.8 age level gives Carbon County the highest ratio of senior citizens per county and lowest ratio of young people in the state. Retired and semi-retired persons living with fixed incomes enjoy the rural nature of the county, and they are still close to the services of Billings. Age is also reflected in the regeneration figures for the county (see Table IV-5).

TABLE IV-5

Rates of Natural Increase

1973	Carbon County	State
Birth rate/1000 Estimated population	13.7	
Death rate/1000 Estimated population	13.2	
Natural rate of Increase/1000 Estimated Population	.5/person	6.3/person

Source: Department of Health 1973

6. Community Services

Since availability of electricity is a factor which potentially influences community growth, increased availability of electricity may encourage growth and in turn may increase the pressure on existing public service facilities in Roberts. A survey of present facilities reveals varying levels of adequacy.

The sewerage system is composed of a settling lagoon and an ingress pipe network which was installed in 1962 with a carrying capacity for 20 years. A renovation study is in progress because of a system overload due to infiltrating ground water and storm water. The 8" diameter pipe system and lagoon should accommodate about 1000 persons, but renovation would begin in July, 1976 at the earliest. The 1974 hook up cost was $470.00.

A water system composed of two 35-foot-deep wells, two 10 horsepower pumps, and a disbursing system was installed in 1964. Each well has the capability to produce 400 gallons per minute, but there is no substantial storage facility. The 1974 hook up cost was $345.00. During the summer, the system runs at or near capacity with 50% of the water used for irrigation systems and the remainder serving the approximate 100 hook ups in Roberts. The lack of storage capacity beyond 30 minutes not only limits potential service, but increases the fire insurance rates for the area.

The school facilities have adequate square footage to accommodate both high school and elementary grade students, because total enrollment dropped from a 1967-68 figure of 224 students to a 1974-75 figure of 99 students. The state equalization program pays 94% of the operation costs (1972 figure). The additional 6% is paid by a combination of county and local school tax levies.

Fire protection service is locally provided by a two truck unit, which is considered adequate for the present population and service area.

Police services are from a Carbon County agency and are considered adequate.

Utilities are provided by the Beartooth R.E.A. through a series of distribution lines from the north. Consumers are concerned about outages in past years and are aware of the need for improvements in reliability.

7. Economic Characteristics

a. Income

The overall economic status of Carbon County is one of reduced incomes and encroaching poverty. Poverty is defined by income level and the figures used below demonstrate a time lag with recent years not covered. Per capita income figures given in Table IV-6 portray an income comparison relative to other significant populations.

TABLE IV-6

Per Capita Income 1970

Per Capita Income	1959	1970
Nation	$2,161	$3,921
State	$2,010	$3,379
Carbon County	$1,462	$2,720

Source: Carbon County Housing Survey, p. 6

The 1970 mean income level that distinguishes a poverty condition in Carbon County was $1,871, while the mean for the state was $1,887. Below these income levels, an individual or family was considered to be living below poverty standards. The actual dollar amount that denotes a poverty condition is based upon family size, number of children under 18 and sex of family head, and therefore varies with the demographic make up of the county. In 1970, 19.2% of the 7080 population (1359 persons) in Carbon County was living below poverty standards. This indicates that 28.6% of the households in Carbon County were subsiding on incomes below the poverty level in 1970 as compared to 16.4% below poverty level households for the entire state. By 1974 the figure for Carbon County decreased to 25.3% of the households, which ranked the county 14th from the highest number of county poverty level households out of 56 counties in Montana.

Poverty figures describe a general county status which cannot be applied specifically to the study area. Out of the 194 persons living in Roberts in 1970, 176 persons belonged to families whose aggregate income was below the poverty level. The 1975 Roberts population is estimated to be 210 (Cole 1975).

b. Taxation

The mill levy used for taxation purposes is especially sensitive to local changes necessitating public services that range from cemetery upkeep to community improvements. The following figures (Table IV-7) depict the county and local tax trends.

TABLE IV-7

Valuation and Tax Mill Levies

	1971-72	1974-75
Carbon County total assessed valuation	$43,838,345	$51,416,097
Carbon County total taxable valuation	$15,767,205	$17,272,161

Tax Mill Levy for Local Taxes

Year	Town	County Levy	School Levy	State Levy	Special Levy	Total
	Roberts	39.37	96.91	6.00	4.64	146.66
1972	Bridger (rural)	39.37	126.81	6.00	2.48	174.66
	Red Lodge (rural)	39.37	107.06	6.00	-	152.43
	Roberts	45.96	112.70	9.00	4.64	172.30
1973	Bridger (rural)	45.96	128.20	9.00	2.07	185.23
	Red Lodge (rural)	45.96	101.86	9.00	-	156.82
	Roberts	40.23	115.61	6.00	5.92	167.76
1974	Bridger (rural)	40.23	134.10	6.00	2.24	182.57
	Red Lodge (rural)	40.23	104.96	6.00	-	151.19

Source: Montana Taxpayers Association 1975

8. Potential Land Use and Growth Trends

a. Agricultural Growth

Trends indicate that agriculture may not remain the primary form of economic support in Carbon County. The following general figures (Table IV-8) are indicative of the quality of the land and climate of Carbon County for farming:

TABLE IV-8

1970 Cash Receipts Per Farm

Nation	$ 18,000
State	$ 24,409
Carbon County (1969)	$ 15,521

Source: Carbon County Planning Office 1974

Lower receipts in Carbon County help account for the continuing 1959-1969 trend of land being taken out of farm production in the county at twice the rate of the rest of Montana (Carbon County Planning Office 1974, p. 5).

Employment trends also reflect a downward rate of farm work and, therefore, laborers as indicated in Table IV-9.

TABLE IV-9

Trends in Farm/Ranch Labor

	1960	1970	Percent Change
County: Farm/Ranch Laborers	869	644	-28.1%
State: Farm/Ranch Laborers	37,673	29,015	-23%

Source: Carbon County Planning Office 1974

Increased mechanization accounts for part of this reduction, but the decrease in the number of farms between 1959 and 1969 (state average is 13.8% and Carbon County average is 17%) is more influential on labor statistics.

The agricultural land base is in need of improvements such as improved irrigation methods, soil stabilization and nutrient increases. A 1970 Beartooth Resource Conservation and Development publication indicated that 94% of irrigated lands needed improved systems and that only 45% of the dry cropland was "adequately" treated (Beartooth RC&D 1970). Improvements are costly and the status of the national agricultural market, especially for cattle, raises doubts about the economic feasibility of many projects at this time.

Despite the rather pessimistic agricultural future indicated by the above statistics, "above average" growth has been attributed to agricultural demands (Beartooth REA 1974, p. 2). This demand represents growth of consumption, presumably by the individual consumer, and does not imply more farms or acres being cultivated. The use of electrically powered irrigation machinery improves sprinkler reliability and water use efficiency, reduces man hour requirements, and therefore allows for the potential of greater profits.

The future rate of growth in electricity consumed by agriculture in the area is somewhat questionable because it will depend heavily on the profitability of expanded sprinkler irrigation. In July, 1976, wholesale electricity rates will increase by 25% (Hyvonen 1975). This increase, plus the inherent instability of agricultural markets, will affect the expected profitability of expanded sprinkler systems.

b. Residential Growth

The recreational amenities of Carbon County, such as rural living conditions, Red Lodge Mountain ski area, and proximity to mountainous national forests, are an attraction for second home ownership, retired persons, and those seeking a non-urban environment. Billings is only one hour away, and there is a strong potential for development of a "bedroom" community associated with Billings in which commuters would live in Carbon County and work in Billings. This potential would be conditionally based on future energy availability. The following census figures (Carbon County Planning Office 1974, p. 2-3) do not reflect residential growth, but the type of growth discussed above is a more recent phenomenon than would appear in the decades covered by the U.S. Census.

TABLE IV-10

Census Data

	1950	1960	1970	Percent Change
Carbon County	10,241	8,317	7,080	-30.9%
Red Lodge	2,730	2,278	1,844	-32.5%
Bridger	854	824	717	-16.0%

Source: Carbon County Planning Office 1974

In 1974, Carbon County had 4,175 acres in platted subdivision proposals, but at that time only 84 homes had been built on 72 acres. The Carbon County Planning Office (1974) estimates that the county population would double (15,600) if two people lived on each lot that is currently platted. The Red Lodge vicinity is included in the planning office study area and contains approximately 1800 platted lots which specifically forecasts a land use change for about 2500 acres. "Rock Creek Mines", "Western Ranch Estates", and "Wagon Wheel Estates" are examples of current projects that substantiate an expectancy for residential growth. Many acres of prime agricultural lands are being utilized for this residential growth, but the final boundaries of residential expansion will depend on the spring 1976 Carbon County Master Plan, the rate of agricultural and industrial growth, and other unpredictable determinants.

A second form of residential growth is the increasing use of mobile homes, indicative of personal preferences, construction economics, and mobility. The Carbon County increase has been from 106 mobile homes in 1970 to 290 in 1974, and this increase is expanding residential land use acreage.

Employment figures (Table IV-11) also indicate a growing construction schedule in Carbon County.

TABLE IV-11

Carbon County Construction Employment

	1950	1960	1967	Percent Change '60 - '67
Construction	171	205	219	+14%

Source: Beartooth RC&D 1974

These figures depict trends of land use change which are simultaneously affecting Roberts. There is the potential for 150 lots in the "city proper" area of Roberts and approximately 240 lots platted within the boundaries of the Beartooth REA Roberts service area (Carbon County Appraisers Office 1975). This potential represents an approximate population increase of 672 persons (2.8 persons/2 bedroom dwelling unit/lot -- Urban Land Institute), which would significantly change the Roberts landscape for the 1970 population of 194 residents.

The demand for electricity per consumer has been forecast for the Beartooth REA (1974).

TABLE IV-12

Electricity Demand Forecasts

Average Monthly Use/Consumer	1971	1975	1983
Residential - Rural	913 KWH	1,145 KWH	1,585 KWH
Residential - Seasonal	211	265	465
Irrigation	1,742	2,195	2,535

Source: Beartooth REA 1974

These figures are only projections. Specific amounts of energy required per customer will depend on many factors, such as cost, but increased total electric use will definitely accompany residential growth.

c. Industrial Growth

Industrial growth is also a definite possibility which would affect land use in the study area. The Cenex plant in Laurel, Montana (thirty miles north of Roberts) is expected to expand, thereby introducing about 450 families into the region (Gribble 1975). Also, the rights to 8,000 acres of coal have been purchased around the Bear Creek area of the county seven miles south of the study area. If this area is developed, the associated population increase and industrial landscape emphasis would affect Carbon County growth trends.

Secondary growth potential may develop from oil and natural gas exploration in the area, a return to coal production from deep mines, or the exploitation of local bentonite supplies. None of these activities are proposed, but they should be considered as possibilities due to local supplies and existing natural resource exploitation in Carbon County.

d. The Future

Carbon County is in a unique period of transition, and the trend which dominates that transition will determine the character of potential land uses in the next decade. U.S. Census data depict a population egress from Carbon County for the period from 1940 to 1970 (see Table IV-1). Alternatively, population estimates for 1971, 1972 and 1973 show sizeable increases in county population.

Growth alternatives are rooted in either agriculture, residential expansion or industrial development. To a limited degree the three are compatible, but the residential growth in Carbon County is recreation oriented. Recreational development not only preempts some prime agricultural lands, but it may also conflict strongly with industrial growth. The individual alternatives are to some extent mutually exclusive, so that pronounced growth of one would determine a dominant land use pattern. The land base is limited, and competition for lands essential to all three types of growth will decide the nature of future land use.

B. Impacts of Proposed Action

Impacts resulting from the construction and operation of the proposed transmission line can be separated into impacts associated with the physical presence of the line and impacts on the Roberts service area due to greater availability of power. The former may be predicted with some precision, while the latter are future possibilities dependent upon trends in growth and other variables.

1. Direct Physical and Aesthetic Impacts

A single, wooden pole transmission system has the potential to disrupt agricultural, scenic, and human settlement areas due to physical, aesthetic, and electrical interference with existing land use. Electrical interferences can be corrected by engineering adaptations. Agricultural and residential disruptions can be mitigated or avoided by pre-construction, landowner conferences. Aesthetic disturbance can be minimized by avoiding areas such as camp grounds or scenic vista points which are especially sensitive to visual disruption.

An impact which may result from the proposed substation location is the potential proliferation of lines emanating from this power source. Common utility corridors should be utilized to decrease impacts by restricting potential conflicts to the least amount of land square footage possible.

The Visual Resources Map (Figure IV-4) identifies one area, visible from the road, that warrants special attention because of its unique features. Topographically, the landscape is marked by escarpments and solitary projections of rock (see Figure IV-4). Elevation changes allow for dramatic views of the distant mountains in which the foreground serves as a harmonious adjunct. This totality represents a unique visual resource. There are no telephone lines or electric transmission systems which linearly diminish the natural expanse of the landscape, and there is only one fence crossing. This landscape is fragile, and its natural attraction would be significantly diminished by a transmission line in the visual proximity to the road.

2. Secondary Impacts

Secondary transmission line impacts in the Roberts service area can be attributed partially to the availability of electricity. Expanded and/or more efficient irrigation systems can be developed if there are adequate water resources. There will be increased reliability of service, and therefore, less inconvenience for consumers. Growth can thus be accommodated from the electrical services perspective.

However, the positive aspects of increased reliability and availability of service also imply negative aspects which should be anticipated and perhaps planned for. Additional availability of power, as a single entity, does not necessarily generate residential, agricultural or industrial growth, but it is one prerequisite for expansion. Expansion, especially if rapid, often involves "hidden costs" to the community. Planning can help minimize these effects.

The need for power in the Roberts area is based on increased consumption by presently metered customers which has brought demand on the existing system up to and exceeding the present capacity; load growth is also a factor of service area consumption. Table IV-13 indicates a growth of mail service consumers, implying residential growth. However, school enrollment (Table IV-14) has decreased primarily due to a low birth rate, thus implying that residential growth is not contributing additional students. This complements evidence presented earlier that residential growth is primarily second homes or retired persons.

TABLE IV-13

Subscribers for U.S. Mail Service in the Roberts Area

Year	Post Office Boxes	Star Rte 1	Rural Rte 1
1972	111	53	-
1973	-	-	83
1974	111	58	78
1975	115	59	94

TABLE IV-14

School Enrollment for District 23-5, Roberts:

Academic Year	Students, Grades 1 to 12
1967-68	224
1970-71	185
1972-73	172
1974-75	99

Residential expansion, which partially will be facilitated by additional power, will add further pressure on community services. Water and sewerage systems necessitated by this growth will result in alterations that will increase the tax mill levy. In a town with a high poverty rate this would have a special impact on the lower income resident. The major problem is outlined in this paragraph from the 1974 Carbon County Housing Survey:

> "A major portion of subdivision in Carbon County is for seasonal second home development. ... Services and facilities used by residents must be extended to seasonal second home dwellers. Taxes do not pay for the services and facilities that must be extended to seasonal second homes. The revenue that does support the services and facilities of the area is resident's income..."

Increased tax levies would also tend to heavily impact retired people living on fixed retirement incomes. As noted previously, Carbon County has a disproportionately large number of older people, and thus the population is more vulnerable to such impacts.

The impacts that are associated with additional electricity are future consequences of growth which necessarily must be addressed by comprehensive planning. Indicators of the need for additional electrical service also suggest the need for planning action pertaining to growth within a given area. The quality and timing of the planning decisions would determine the severity of the aforementioned growth impacts on Carbon County residents.

V Recommendations and Mitigating Measures

It is recommended that the application for the Roberts 69 KV transmission line be conditionally approved with mitigating measures concerning line location and construction activities. The engineering analysis concludes that electrical reliability problems in the Roberts service area would be solved by constructing either a 100 KV or 50 KV transmission line from Bridger. Thus the need for the proposed line. has been established based on the condition of the existing system, current voltage drops, and future growth assessments.

The location of the line proposed by the applicants has been altered with respect to a visual resource area. The recommended alignment (see Figure V-1) utilizes topography and vegetation to mitigate visual impacts upon a resource area unique in geologic attractions, panoramic views and undisturbed natural condition (see Figures V-2, V-3, V-4 and V-5). Rough calculations indicate that the recommended alignment would add an approximate 500 feet to the length of the line.

The direct impact, i.e., electromagnetic effects, of the line on the natural system will be negligible, but construction and maintenance activities could be very disruptive unless carefully controlled. The following construction guidelines will mitigate many of these adverse impacts:

1) Road development should be limited to that amount absolutely required for the construction of the line.

2) Where disturbance of the soil-vegetation systems takes place, re-seeding should be done at the next

suitable season utilizing native plant species. A second attempt should be made to re-seed the area if the first effort fails. Hydroseeding, utilizing some binding material, must be undertaken for disturbed areas with slopes exceeding 15%.

3) Sediment traps should be constructed in any disturbed area exceeding 0.5 acre in size. There is a serious sedimentation problem in the study area, and this should help limit the overall impact.

4) Poles should be placed at least 50' from intermittent or permanent streams.

5) Construction should be done when the soil is neither saturated nor subjected to periods of heavy rain.

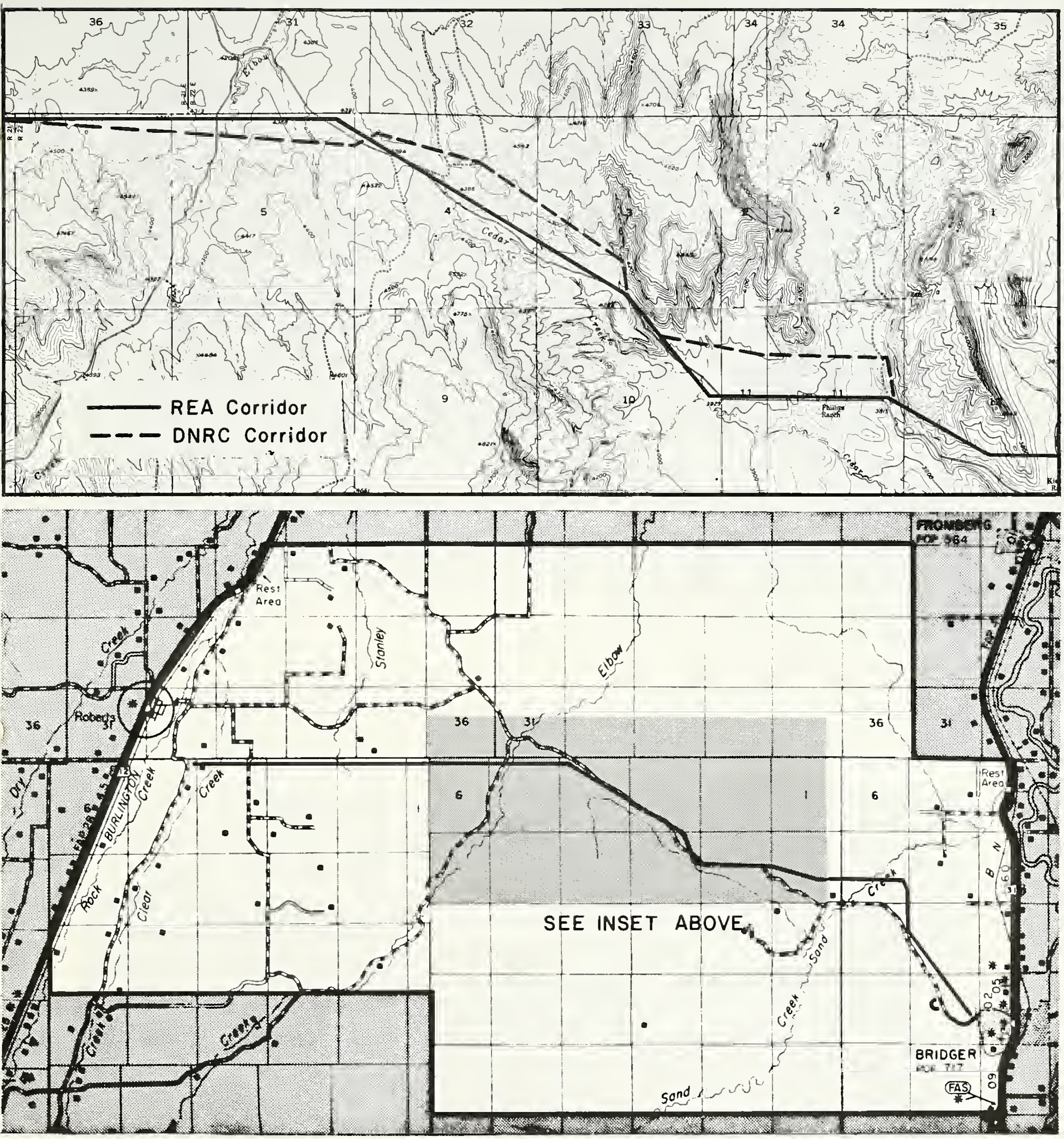
6) Cultivated portions of the corridor area should be avoided by following existing fence lines.

7) The final alignment should avoid the horizon line of hills bordering the road and utilize side slopes of less than 15% to mitigate visual impact.

8) Construction roads should avoid the horizon line of hills and adhere to lower slopes to mitigate visual impact.

9) Common corridors should be developed for the ingress/egress routes from the substations.

10) The clearing of right-of-way corridors should be kept



PROPOSED BEARTOOTH TRANSMISSION LINE

LEGEND

Proposed Transmission Corridor

BRIDGER TO ROBERTS
50 KV LINE

SCALE:
0 ½ 1 2 3 4 Miles

N

SOURCE:
Beartooth Electric Cooperative, Inc.

FIGURE ~~II-1~~
V-1

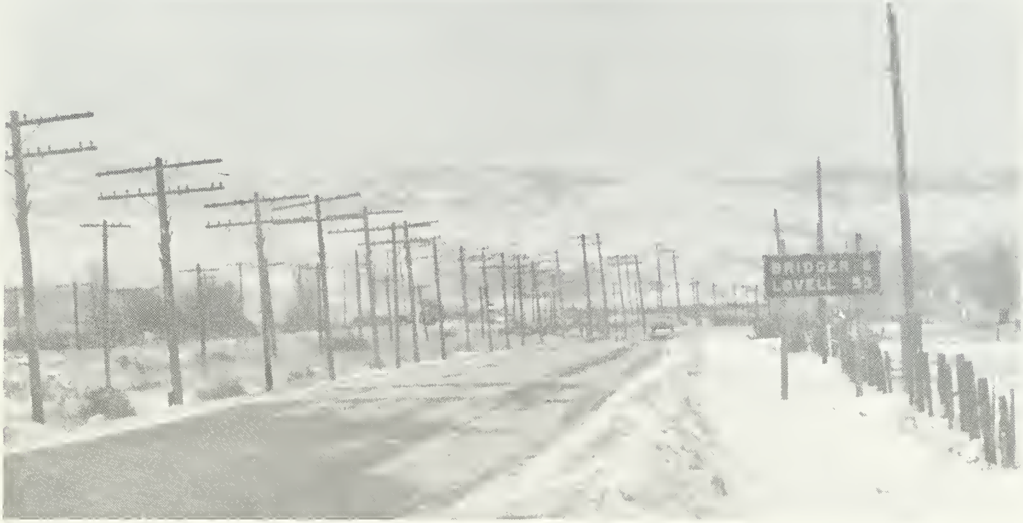


Figure V-2. The Clarks Fork Valley of the Yellowstone River accommodates irrigated land, Burlington Northern railroad tracks, Route 310, telephone and utility lines, residential development and associated facilities for human habitation.

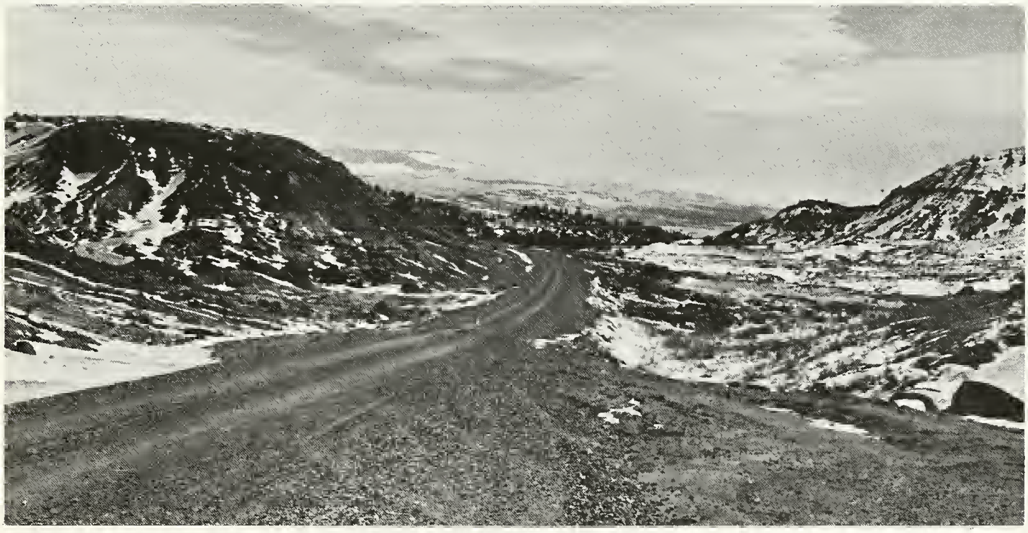


Figure V-3. A portion of the visual resource setting in the study area offers an unencumbered landscape that is rich in points of interest and serves as a harmonious foreground for panoramic views.

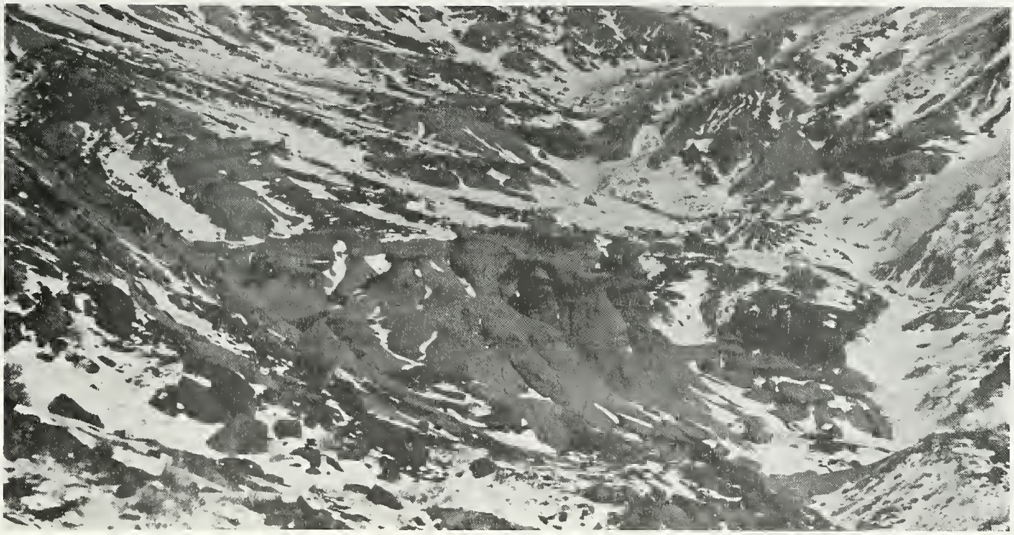


Figure V-4. Differential resistance to weathering and erosion has created a "Devils Kitchen" of unique rock formations that are focal points for passive forms of recreation.

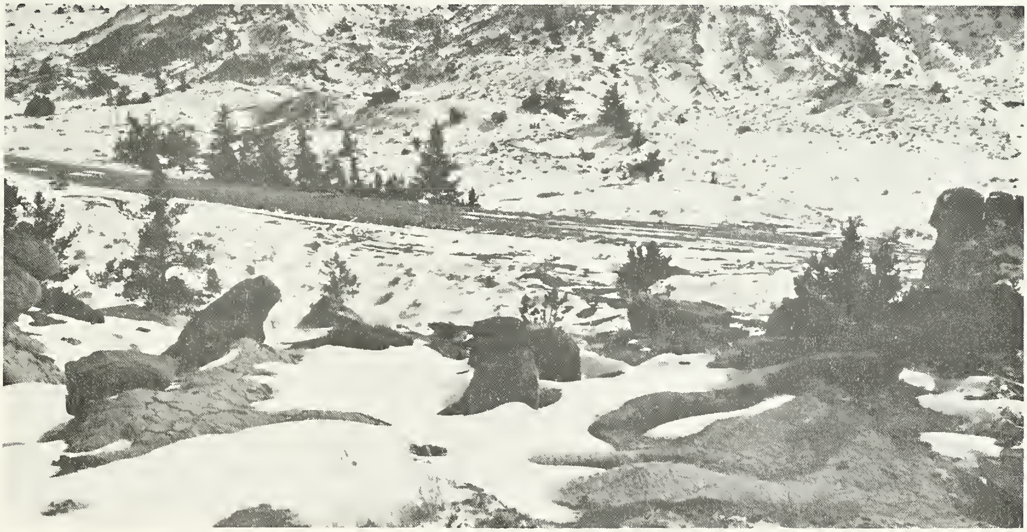


Figure V-5. A graded road represents the major influence of man's use of this unique landscape other than for aesthetic purposes. The absence of the paraphernalia for modern existence offers a moment of visual, landscape serenity.

to an absolute minimum in order to maintain an irregular, naturalistic effect.

11) Avoid long tunnel views down a corridor by changes in alignment and using terrain or vegetative concealment.

Secondary impacts of the line are indirect and involve long term land use decisions that will be made concerning the region. These decisions involve urbanization/industrial encroachment on agricultural lands, the amount of land to be irrigated, the quality and opportunity for recreational experience and, in many ways, the quality of the environment for all people and other living things.

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